JULY 11, 1958

electronics

business edition

A McGRAW-HILL PUBLICATION • VOL. 31, NO. 28 • PRICE FIFTY CENTS

Fighter Market Passes $1 Billion

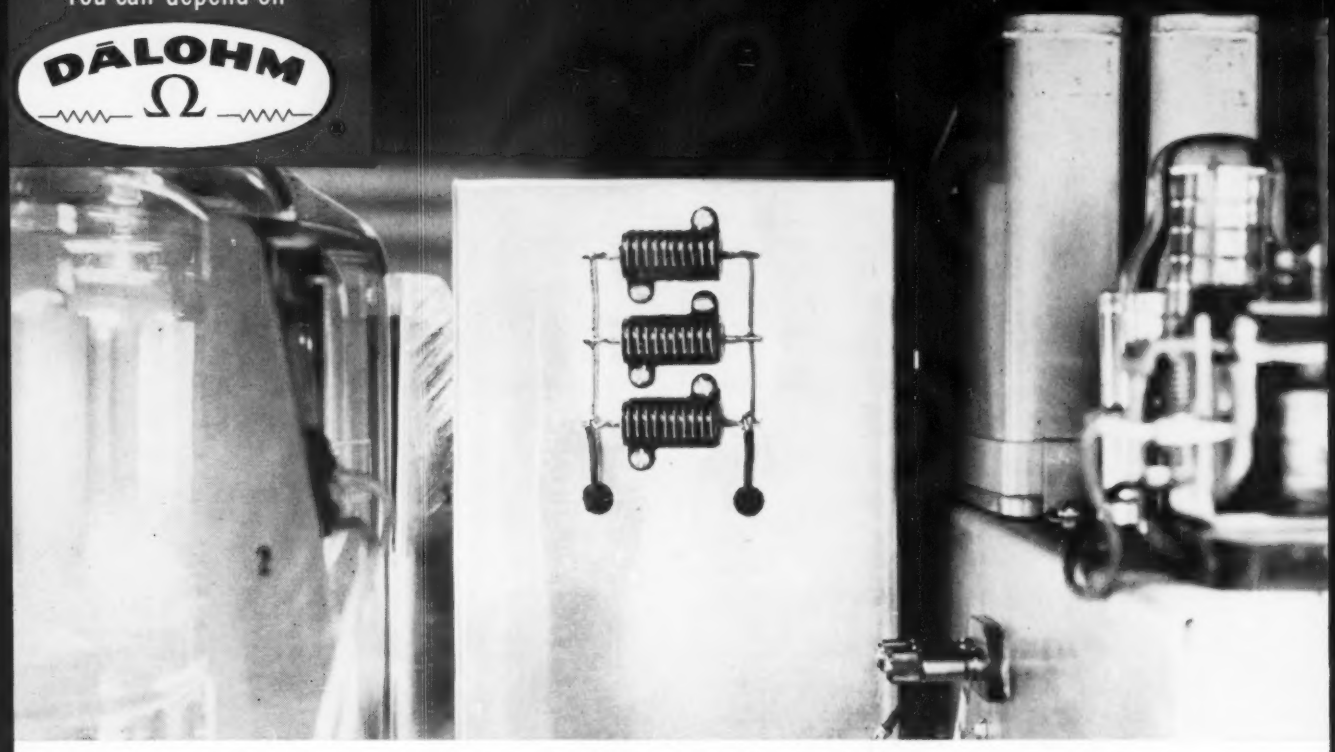
Air-to-air rockets, complex controls account for increased sales volume . p 13

Electronics Grows in Printing Trades

Press controls are common today. Will tomorrow bring more electronic typesetting? . p 15

You can depend on

DALOHM Ω



Submitted to HIGH AMBIENTS while under load... yet retain 100% reliability!

Most requirements for DALOHM RH and PH miniature wire wound power resistors are not as severe as the high ambient situation shown above; but, when you need dependable miniature power resistors that will meet tough requirements, refer to these specifications:

- Operating temperature range: −65° C. to 275° C.
- Precision tolerance range: ±0.05%, ±0.1%, ±0.25%, ±0.5%, ±1% and ±3%.
- Rated at 10, 25, 50, 100 and 250 watts.
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- Surpasses requirements of MIL-R-18546B.
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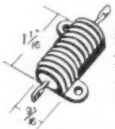
DALOHM RH and PH Type resistors have a precision wire wound element, with all welded construction from terminal to terminal. It is inserted in a special shock absorbing compound, inserted and sealed in a radiator finned anodized aluminum housing for maximum heat dissipation on panel mounting.

These miniature Powerhouse resistors offer complete reliability under the most demanding operating conditions.

RH-10
10 watts,
.5 ohm to
30K ohms.



RH-25
25 watts,
.1 ohm to
15K ohms.

RH-50
50 watts,
.3 ohm to
100K ohms.

RH-250
250 watts,
.3 ohm to
35K ohms.

PH TYPE

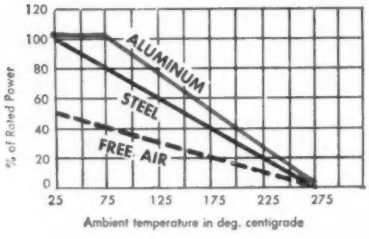
New vertical hole mounted power resistor with same outstanding features of miniature RH types.

PH-10-1
10 watts,
.5 ohm to
60K ohms.

PH-25
25 watts,
1 ohm to
60K ohms.

PH-100
100 watts,
.5 ohm to
35K ohms.

TYPICAL RH-25 DERATING CURVE



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Shoptalk . . .

FIGHTER-PLANE MARKET. Despite emphasis on guided-missiles, Air Force and Navy are still relying heavily on manned interceptors.

> **Thirty-five percent of the cost of Convair's F-106 goes for electronics. Electronic ground support gear for each interceptor wing is valued at $2.5 million. Electronics in air-to-air guided missiles carried by fighters represents many millions more. Total spent for electronics in Air Force and Navy fighters each year is well over $1 billion.**

A close look at this growing market begins on p 13 in Associate Editor Mason's article, "Fighter Market Passes $1 Billion."

ELECTRONICS IN PUBLISHING. Electronic circuits are being used increasingly for press-room controls, and more electronic applications are on the way. Electronic typesetting came in for discussion at the recent American Newspaper Publisher's Association's Mechanical Conference at Atlantic City.

> **Associate Editor De Jongh contacted newspaper publishers, equipment manufacturers and research groups to get the overall view of the field. Midwest Editor Harris visited the *Chicago Sun-Times*' new plant and New England Editor Maguire visited the *Boston Globe's* layout to get on-the-spot information Their combined story begins on p 15.**

HOW MUCH IS YOUR FIRM WORTH? This year many electronics executives will have to put a dollar value on their firms in connection with merger opportunities and capital raising plans.

> **Their valuations may be the most important decisions of their respective business careers. In making these decisions, few executives can call on past experience.**

To determine the factors affecting the value of electronics companies and set up rough guides which can be used in arriving at values, Associate Editor De Jongh and Pacific Coast Editor Hood interviewed electronics industry executives and financial experts specializing in the industry. The editors' joint story appears on p 17.

ENGINEER SURPLUS? Ever since the economy started readjusting from its December '56 high, the manpower market has been changing. Right now it's a buyers' market, but not too much so.

> **There's a demand for good engineers, both experienced men and hot-shot grads. But the men who do the hiring and screening are doing it carefully, selectively.**

To get the feel of the changes, Associate Editor Leary quizzed personnel men and chief engineers, engineer personnel services, college placement bureaus. His story telling what kind of engineers are in demand and how companies screen them appears on p 18.

Coming in Our July 18 Issue . . .

Coming In Our July 18 Issue . . .

● **Radiation Safety.** Protection from the hazards of nuclear radiation is provided by General Electric's transistorized control system for atomic reactors. According to authors E. J. Wade and D. S. Davidson, the trip system guards against dangers from nuclear radiation and offers maximum critical assembly safety even at the expense of reactor plant shutdown. Misfunctioning in the ion-chambers or component failures in the circuit generate a trip signal that drops the reactor control rods.

Auxiliary trip circuits guarantee fail-safe operation as each can shut down or scram the reactor. System has a dual-function bistable circuit, AND and OR gates, a feedback-type regulator control amplifier and an undercurrent relay circuit.

● **Analyzing Brain Waves.** Output from an electroencephalogram feeds an analog computer whose Schmitt-trigger and flip-flop circuits chart the behavior of irregular electrical waveforms from the human brain in the system described by C. J. Zaander of AMF.

Author Zaander's approach to neurophysiological indexing of brain waves uses derivative curves of the primary brain signals to quantitatively describe wave-shape deviations in terms of time and amplitude. One important possible application of the unit is the study of human adaptability to space travel.

● **Battery Upsurge.** Stimulated by the needs of burgeoning missile and satellite research, batteries are enjoying a rebirth of interest and development. Missile designers are more frequently exploiting the excellent advantages of these tiny devices, older than electronics itself. And with their extensive use have come new and unusual batteries.

David Linden and Arthur Daniel of the U. S. Army Signal Engineerings Labs discuss the applications and the limitations of some of the latest batteries including the still-secret thermal cell. A battery selection chart presents in tabular form the general characteristics, advantages, limitations and other features of a number of battery types for missile applications.

● **Crystal Cutting.** Authors Brumbach, Bennett and Chalker of Union Thermoelectric Corp. describe another step that the electronics industry has taken in automating itself. They have simply taken the guess out of crystal lapping.

The audio output of a receiver, connected to the crystal being lapped and to which the lapping machine operator normally listens, triggers a circuit that turns off the machine. Thus, crystal thickness is determined by a circuit rather than an operator's ear. With this development operators can run at least twice as many machines with improved production accuracy.

electronics business edition

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electronics

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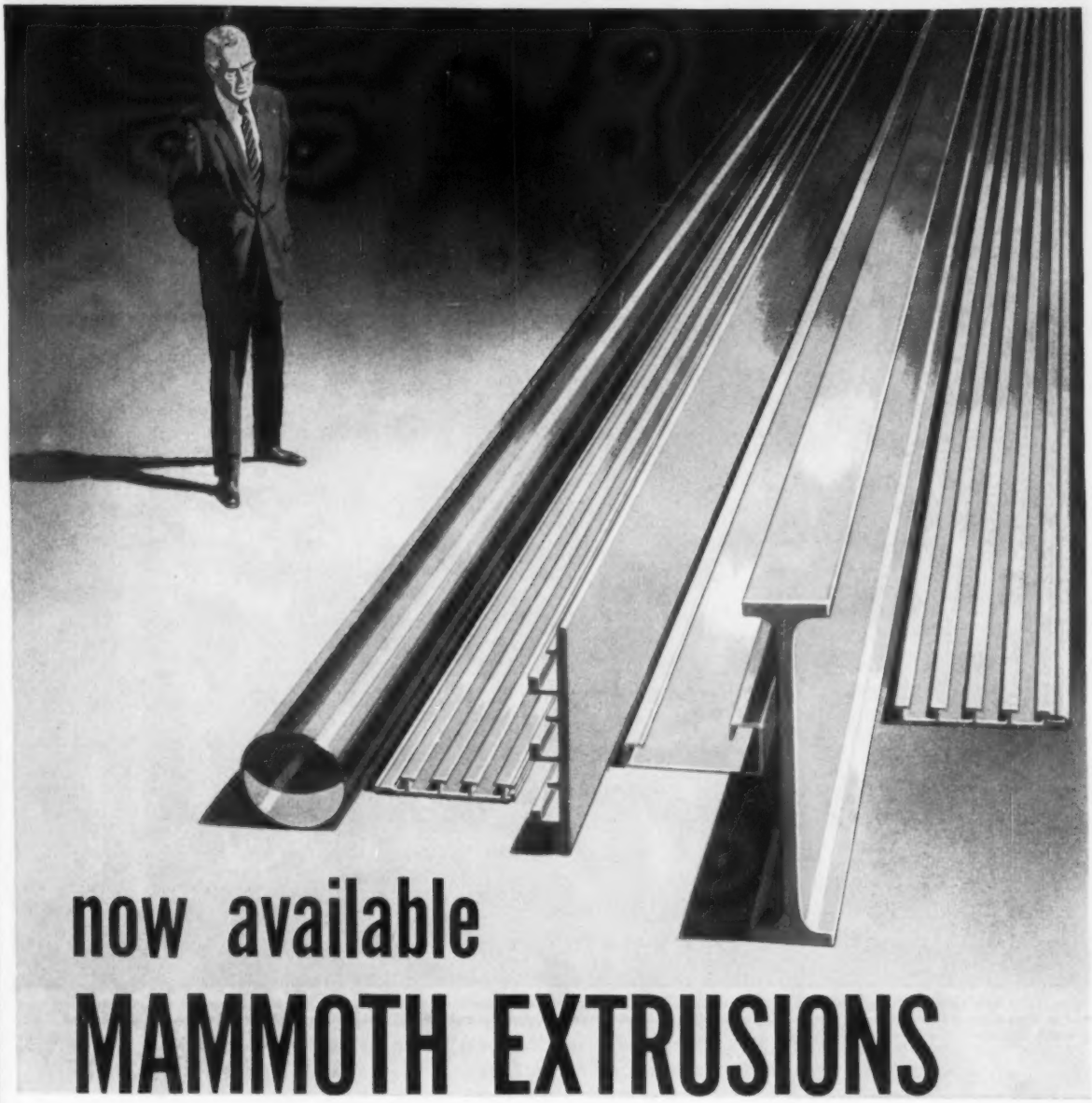

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Big magnesium and aluminum extrusions produced from Dow's 13,200 ton press

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5. **COMBINED HOLLOW EXTRUSION-FORGINGS**

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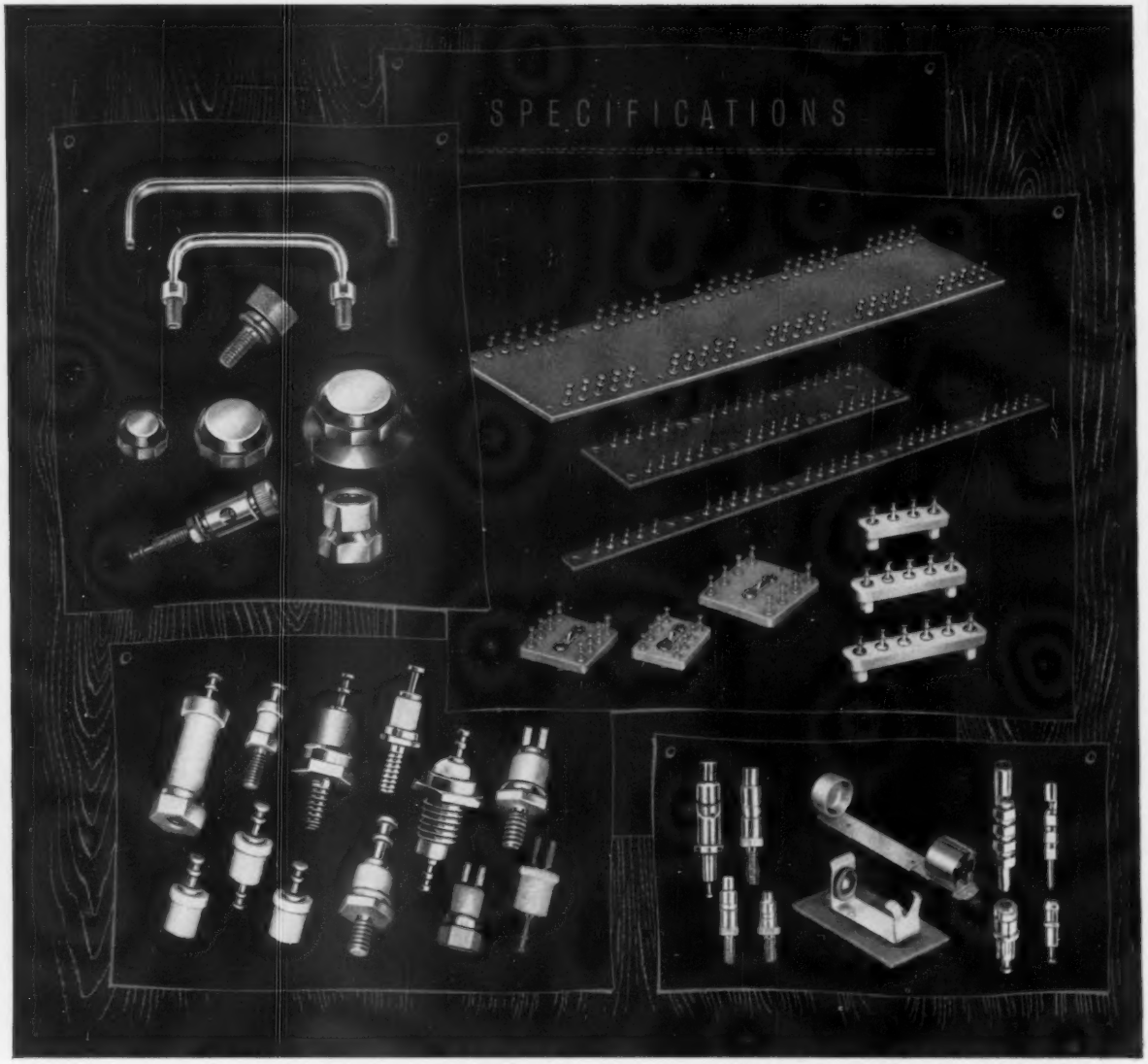

Photo shows wide variety of Cambion® components. Upper left, handles, knobs, panel screws, and binding posts. Upper right, standard and miniature terminal boards, phenolic and ceramic. Lower left, split lug terminals, insulated terminals in ceramic and Teflon.* Lower right, diode clips, battery clips, plugs and jacks. Common denominator — Cambion reliability.

*DuPont Reg. T.M.

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Merger Pace Holds

Electronics firms figure in 94 out of 853 mergers — 11 percent — throughout nation in eight months

PACE OF MERGERS in the electronics industry this week shows no sign of slacking. In fact, industry leaders in recent months have been predicting that the number of mergers will increase.

A check by ELECTRONICS of all publicly announced mergers over an eight month period shows that electronics firms figured in 11 percent of all U.S. business mergers.

There were 853 mergers announced between Sept. 11, 1957, and May 10, 1958, and in 94 cases an electronics firm was either the acquiring or the acquired firm.

Count was based on all merger announcements noted by leading financial and business publications, plus newspaper financial sections. Though this combined group of publications affords one of the most complete merger checks possible, the total number of mergers is still somewhat understated for both all business and electronics firms. Mergers between privately owned firms often do not receive public notice.

A comparison of general business mergers with electronics firm mergers in each of the eight monthly periods follows:

	Number of Merger and Acquisition Announcements		Percent Electronics
	All Business	Electronics	
Apr. 11, 1958-May 10, 1958	91	9	9.9
Mar. 11, 1958-Apr. 10, 1958	117	20	17.1
Feb. 11, 1958-Mar. 10, 1958	82	10	12.2
Jan. 11, 1958-Feb. 10, 1958	105	12	11.4
Dec. 11, 1957-Jan. 10, 1958	111	6	5.4
Nov. 11, 1957-Dec. 10, 1957	114	15	13.2
Oct. 11, 1957-Nov. 10, 1957	104	15	14.4
Sept. 11, 1957-Oct. 10, 1957	129	7	5.5
Eight Month Total	853	94	11.0

In each of the eight months electronics firms played a part in more than five percent of all business mergers.

In six of the eight months firms in our industry figured in about 10 percent or more of all mergers that took place.

Main buying reasons behind these mergers were: to strengthen management, to diversify and offset seasonal or cyclical fluctuations, to take advantage of a tax loss, to add new product lines, to insure continuing supplies through industry integration and to improve earnings by more efficient use of available capital.

Main selling reasons were: management's desire to retire, inheritance tax considerations, inadequate capital to expand, limited product lines and resulting high distribution costs, different philosophies within ownership groups and acts of God, such as fires, windstorms, floods and other catastrophies.

SHARES and PRICES

AIRCRAFT ANTICOLLISION system spending may favorably influence the sales and earnings prospects of one or more of the five firms listed below. According to the Air Navigation Transport Committee of the Air Transport Association, this group of firms, along with several non-public organizations, is working on developing aircraft anticollision warning systems.

The attention given to the need for anticollision system development because of the many recent airway collisions should ensure stepped up government spending in this area. Also, increased use of electronic aids will be relied upon to make the nation's airways safer (ELECTRONICS, p 8, June 27).

The impact of increased business resulting from anticollision contracts on the earnings and stock prices of any of the five firms will vary considerably depending on the ratio of new and old business.

The fact that the larger more diversified companies retain and improve their respective positions in the industry and the stock market by getting their share of new and growing business opportunities is also something well worth considering.

Aircraft Anticollision System Developers	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share 1958	Period	1957	Traded	1958 Price Range
Gen'l Tire & Rubber (Aerojet-General)	24⅜	0.70[2]	2.9	0.30	(3 mos)[3]	1.95	NYSE	22¼–30
IT & T	37⅜	1.80	4.8	0.84	(3 mos)	0.82	NYSE	29¼–37⅜
Minneapolis-Honeywell	91⅝	1.75	1.9	0.61	(3 mos)	0.79	NYSE	76 –92
Packard-Bell	12¼[1]	0.50	4.1	0.60	(6 mos)	0.59	OTC	10⅛–12¼
RCA	35⅝	1.50	4.2	0.59	(3 mos)	0.87	NYSE	30¼–35¾

[1] bid [2] plus stock [3] ending Feb. 28

MERGERS, ACQUISITIONS and FINANCE

• **Three electronics firms** with interim fiscal periods ending April 30 recently issued part-year earning statements that compare favorably with last year. **Perkin-Elmer** earned a net profit of $490,215 for nine months, a 40-percent increase over the same period last year. **Northrop Aircraft** reported nine-month net earnings of $4,732,187, an increase of 33 percent over 1957.

Hewlett-Packard's net income for six months amounted to $1,034,966, two percent higher than first half of 1957.

• **Technology Instrument,** Acton, Mass., joins the ranks of publicly owned companies. Its first stock issue consisted of 260,000 shares of common at $9.50 per share, including 204,775 shares from holdings of company officials and 55,225 shares being sold by the company. Net proceeds from sale of company shares, after deducting underwriting commissions of $1.25 per share, were $455,606. The Acton firm will use the money to finance expected increase in volume on present products and for marketing a newly developed precision potentiometer. About $100,000 will be used to expand production facilities of the instrumentation program at subsidiary **Acton Laboratories, Inc.**

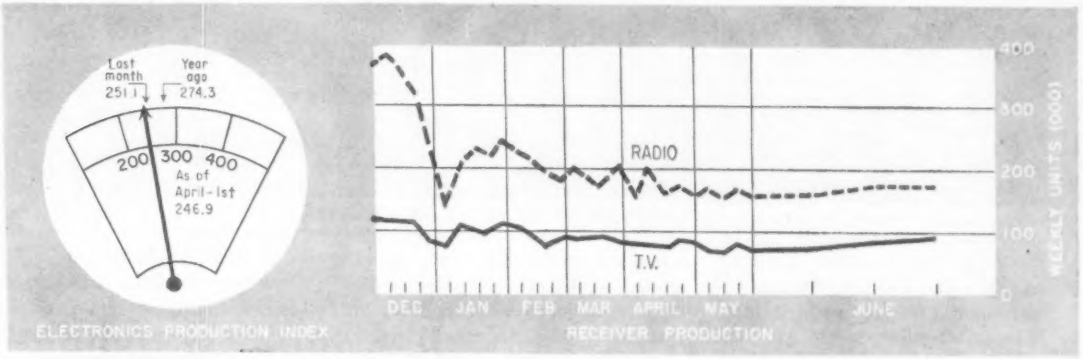
S. D. Fuller & Co. of New York and five other underwriters have underwritten the issue on an all or none basis.

• **Chesapeake Instrument Corp.,** Shadyside, Md., offers its stockholders rights to subscribe to 24,006 new common shares at rate of one new share for each five shares held. Subscription price is $8 per share. Proceeds will be used for repayment of a $20,000 advance; $40,000 for repayment of bank loans and $60,000 for plant additions. Remainder will be retained in working capital. The firm is engaged in research, development and manufacture in the electroacoustic and electronic fields. Drexel & Co. of Philadelphia is underwriting the offering.

• **Standard Coil Products** expects to report profitable operations for the first six months of 1958, president James O. Burke told stockholders at firm's annual meeting in Melrose Park, Ill. While Burke declined to predict the exact figure, he told shareholders that improved operations in all divisions of the company should more than make up for company's first quater loss.

• **Chance Vought,** Dallas, Tex., joins parade of aircraft firms with growing electronics operations.

Last month it set up **Genesys Corp.** in Los Angeles as a wholly owned subsidiary specializing in electronics.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	June 20, '58	June 13, '58	June 21, '57
Television sets, total	81,999	76,029	142,910
Radio sets, total	160,531	162,575	252,299
Auto sets	55,453	51,698	98,616

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	June 25, '58	June 18, '58	June 26, '57
Radio-tv & electronics	47.98	49.05	51.19
Radio broadcasters	61.79	63.36	65.14

FIGURES OF THE YEAR

	1958	1957	Percent Change
	Totals for first four months		
Receiving tube sales	117,596,000	153,011,000	—23.1
Transistor production	11,895,032	6,899,000	+72.4
Cathode-ray tube sales	2,403,182	2,952,318	—18.6
Television set production	1,523,858	1,835,975	—17.0
Radio set production	3,532,066	5,075,180	—30.4

LATEST MONTHLY FIGURES

EMPLOYMENT AND EARNINGS

(Source: Bur. Labor Statistics)	Apr. '58	Mar. '58	Apr. '57
Prod. workers, comm. equip.	338,500	343,800	380,600
Av. wkly. earnings, comm.	$79.95	$80.16	$79.19
Av. wkly. earnings, radio	$78.78	$79.39	$76.61
Av. wkly. hours, comm.	38.9	39.1	40.2
Av. wkly. hours, radio	39.0	39.3	39.9

TRANSISTOR SALES

(Source: EIA)	Apr. '58	Mar. '58	Apr. '57
Unit sales	2,856,234	2,976,843	1,774,000
Value	$7,025,547	$6,795,427	$4,880,000

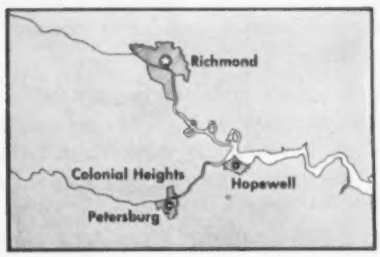
TUBE SALES

(Source: EIA)	Apr. '58	Mar. '58	Apr. '57
Receiving tubes, units	32,582,000	28,524,000	27,970,000
Receiving tubes, value	$28,788,000	$25,716,000	$25,384,000
Picture tubes, units	590,357	634,779	629,838
Picture tubes, value	$11,591,733	$12,643,404	$11,394,043

The great political boat race

it started something for your new plant

RICHMOND
PETERSBURG
HOPEWELL
COLONIAL HEIGHTS
VIRGINIA



Like a pair of racing turtles, two lumbering canal boats headed west from Richmond that December day in 1840. One backed by Whigs, the other by Democrats . . . each determined to be first over the 146 miles of newly extended James River Canal. The race proved prophetic. The Whig boat, *William Henry Harrison* won . . . as did Harrison himself that very Fall!

Today, over the old canal route runs one of five mainline railroads to serve your plant in the Richmond-Petersburg-Hopewell triangle. In addition, you have 56 truck lines, five major airlines, plus deep-water ocean shipping.

Your products move overnight to New York, Atlanta or Cincinnati. Yet you enjoy such Southern advantages as conservative manpower, mild climate, friendly government. And you draw electric power aplenty from Vepco's growing network . . . with 640,000 kilowatts of added capability now building, to reach a total of 2,171,900 kw in 1960. For more facts and confidential site-finding help, write, wire or phone Vepco . . . serving the "Top of the South" in Virginia, West Virginia and North Carolina.

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WASHINGTON OUTLOOK

LIBERALIZATION of military-contract renegotiation policy, long urged by many electronics manufacturers, does not seem to be in the cards. Congress is moving to extend the Renegotiation Act for two more years. The present law, which expires Dec. 31, provides for renegotiation by an independent government board to wring out excessive profit on defense business. Odds are that Congress will renew the law as is.

Industry men seek amendments to the Renegotiation Act which would eliminate some of the hardships they now find in the law. They want new ground rules on recapture of profits earned under incentive-type military contracts—frequently renegotiated as long as four years after payments are made. They claim that the Pentagon's price revision processes already act as a check on contractor profit rates.

But so far the administration is standing firm against new exemptions from the defense renegotiation procedure for military contracts with incentive clauses. Officials at the Renegotiation Board argue that such an exemption would eliminate much of the contracts now held by aircraft and other large military producers, that the exemption would be "almost the same as having no law at all."

According to latest statistics, the Renegotiation Board recovered some $431 million as excess profits from defense contractors in the past year.

- **New federal aids** for small electronics firms seem certain to be passed before Congress adjourns this summer.

  The Senate has already voted a $250-million Capital Bank Act to provide loan funds to small firms for purchase of capital equipment. A slightly different version has been reported out by the House Banking Committee. Both measures would authorize the Small Business Administration to charter private investment companies to make loans to small companies for capital equipment expenditures.

  Also, tax relief for small firms is on the way: (1) extension of fast depreciation allowances for purchase of up to $50,000 on used machinery and equipment; (2) allowing corporations with no more than 10 stockholders to be taxed as partnerships; (3) granting a 10-year payment period for estate taxes where the estate is made up mainly of investments in a closely held corporation (now due 15 months after death); and (4) boosting the $1,000 limit that original investors can deduct as capital losses.

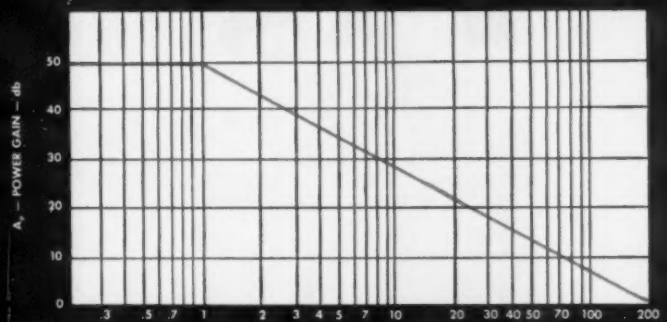
- **Defense Dept.'s** newly accelerated program to place defense business in labor surplus areas has resulted in a $222,546 Navy Bureau of Ordnance contract with Kearfott of Paterson, N. J. Contract is for fire-control equipment. It was awarded on the basis of a setaside and is apparently the first military electronics award granted under the administration's recession-stimulated policy.

- **Greater Air Force** supervision over weapon-system prime contractors is predicted as part of the Pentagon's new look at weapon-system management. The new restrictions, however, are more likely to be a matter of degree in administration rather than the declaration of tougher regulations.

  An Air Force procurement policy-maker explains it this way: "We had to go too far (in delegating powers to weapon-system primes) . . . now we're trying to back off and carry more responsibilities in the Air Force."

CIRCLE 5 READERS SERVICE CARD →

NEW P-N-P germanium 90 MC alpha cutoff T/I diffused base transistors



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maximum ratings at 25°C

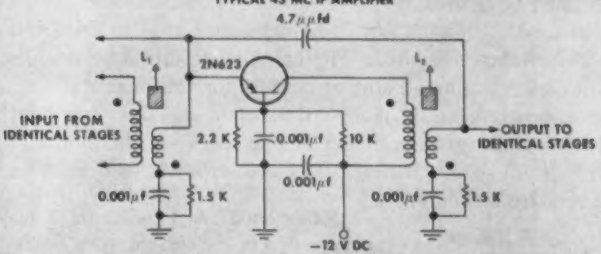
collector to base	−30V
collector to emitter	−15V
emitter to base	−1V
total dissipation	40mW

typical design characteristics at 25°C

	(conditions)		
collector reverse current	$I_E = 0$	$V_{CB} = -20V$	2μA
emitter reverse current	$I_C = 0$	$V_{EB} = -0.5V$	0.5 μA
forward current transfer ratio	$I_C = -2mA$	$V_{CE} = -6V$	35
current transfer ratio cutoff frequency	$I_C = -2mA$	$V_{CB} = -6V$	90 mc
max. frequency of oscillation	$I_C = -2mA$	$V_{CB} = -6V$	200 mc
frequency where h_{fb} is unity	$I_C = -2mA$	$V_{CB} = -6V$	60 mc

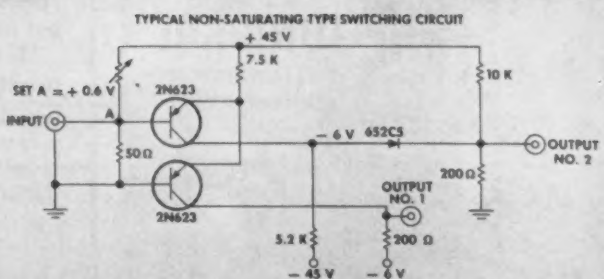
APPLICATION NOTES

TYPICAL 43 MC IF AMPLIFIER



TYPICAL VALUES — AVAILABLE POWER OUTPUT 20 mW (PEAK) NOISE FIGURE 6 db • POWER GAIN 15 db • BAND WIDTH, ONE STAGE 11 mc APPROX. IMPEDANCE LOOKING INTO PRIMARY 56 Ω • LOAD ON SECONDARY 3000 Ω

TYPICAL NON-SATURATING TYPE SWITCHING CIRCUIT



TYPICAL SWITCHING TIMES OBTAINED IN ABOVE CIRCUIT
t_{on}: 14 mμsecs t_{off}: 14 mμsecs
(INCLUDES OSCILLOSCOPE RISE TIME)

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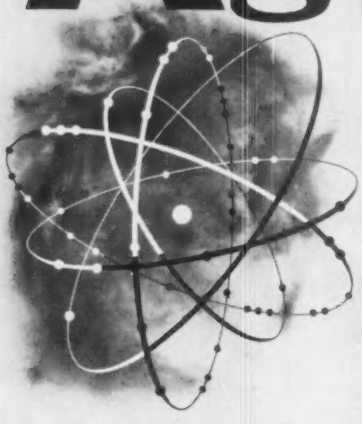
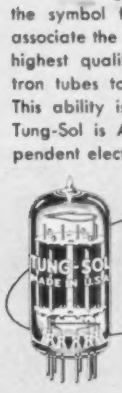


Symbol for silver . . . the element used in grid support wires to conduct heat away from grid.

Just as engineers recognize Ag as the symbol for silver, so do they associate the name Tung-Sol with the highest quality production of electron tubes to volume requirements. This ability is a major reason why Tung-Sol is America's largest independent electron tube manufacturer.



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ELECTRON TUBES
SEMICONDUCTORS

Tung-Sol Electric Inc., Newark 4, N. J.
Manufacturers of Automotive and Electronic Components.

CIRCLE 6 READERS SERVICE CARD

EXECUTIVES IN THE NEWS

Haggerty: elliptical orbit

When Texas Instruments oldtimer J. E. Jonsson stepped up to the firm's board chairmanship this spring, it was natural that 44-year-old Patrick E. Haggerty should succeed him as president. For there's no one who knows the company quite so well as the man who has been Jonsson's right hand since 1950.

Haggerty, a quiet toughminded Irishman, was born on St. Patrick's Day 1914 in Harvey, N. D., took his BSEE at Marquette in 1936. While in college he worked for a Milwaukee boxmaker, the Badger Carton Co. After graduation he stayed there for a while, became assistant general manager, married a local girl and prepared to settle down.

The war changed all that. It shoved him both into the Navy and back into electronics. He headed the production branch of BuAer's electronic components group from 1942 until war's end. In 1945, Geophysical Service, Inc., later to diversify and grow into TI, copped him for a managerial job.

He headed TI's laboratory and manufacturing operations until 1950, then moved up as executive vice president. For the last eight years he's been concerned with plans and policies as the Dallas-based manufacturing firm spread out and grew up.

Management is his profession—"a fascinating pursuit," he calls it—and method is his tool. He points out that few moves are accidental: "the accident is always with you and at times you seize opportunities; but most acts must be deliberate."

He works hard, puts 10 hours into most days, continues to think out his problems while he reads at home. He finds that reading history gives him depth and understanding—a sort of context for the present.

Haggerty is a devoted family man; an associate describes his orbit as "elliptical, with professional activities at one focus and his home at the other." He spends as much time as he can with his wife Beatrice and their five very Irish children.

COMMENT

Noise on Sonar

Your sonar figures (in "Nuclear Navy Goes Electronic," June 13, p 15-16) are a little off, aren't they? You say "Present-day subborne sonar has at least three times the range of radar. . . ." That would mean it could pick up targets 600 miles away and more.

Then there's the radar in

BMEWS, which has a range of 3,000 miles or so. And 9,000 miles is quite a haul for a weak little sound wave. No sonar system is that good.

W. R. Miller
Cleveland, O.

Well, naturally not. We should have been a little more specific, as we were in the article "Sonar: Key to Sub War" (June 27, p 15). Three times radar range at the surface is what we meant. For anti-submarine work, radar reaches only 20 miles or so—to the horizon—and three times that is 60 miles. But sonar's doing a lot better than that, and a system to eavesdrop on sounds generated 600 miles away wouldn't surprise us unduly.

Federal Aviation

. . . Well, the Federal Aviation Agency will now be able to have a go at cleaning up the air mess. Wonder how long they'll struggle before they give up?

Renner Colvin
Phoenixville, Pa.

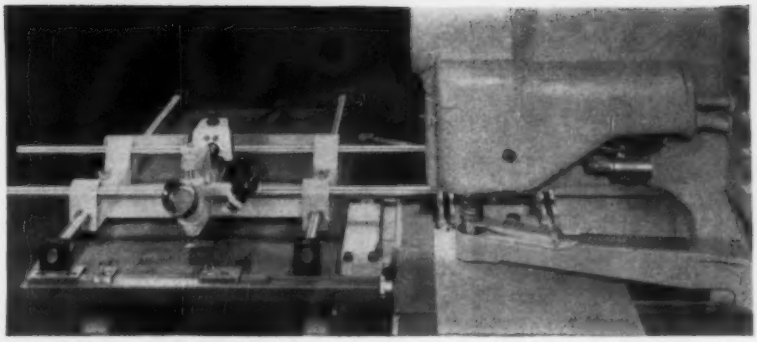
I've been following your articles on developments in air traffic control, and I want to express my thanks to you for the way you've been handling this matter.

What I don't understand is the proliferation of agencies. We've had CAA and CAB; now all of a sudden we've got FAA piled on top and AMB running around in between. How can all these bureaus stay out of each other's hair?

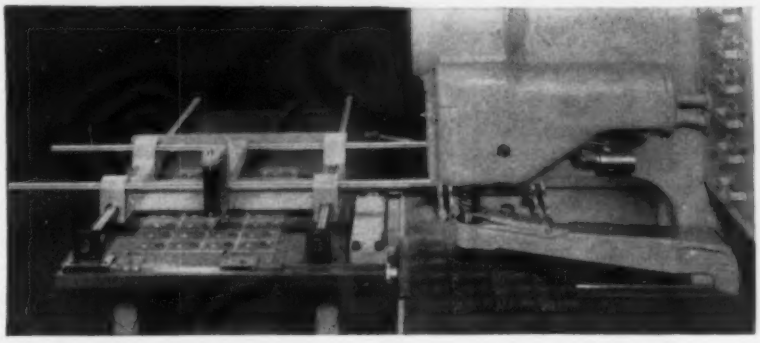
I thought there was a bill before Congress to do away with all of them and start all over with a cabinet-level Department of Transportation and Communication.

Robert Foster Pruitt
Providence, R. I.

FAA will help by taking over CAA, AMB, rulemaking functions of CAB. Rep. J. A. Younger (R., Cal.) puts his bill in the hopper each session; maybe it'll get somewhere someday. Commerce Undersecretary L. B. Rothschild indicated to us at lunch the other day that FAA, in his private estimation, was a step toward the cabinet department idea.



a faster way to
cold-punch printed circuits



The DUPL-O-SCOPE

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SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SC58-4

electronics
business edition
JULY 11, 1958

"Flight test package" for an average proving flight of the F-104 costs $200,000. Instrumentation for complex test flights may hit $1 million

Fighter Market: $1 Billion

Despite progress with guided missiles as an antiaircraft defense weapon, our present air defense force is still made up largely of manned interceptors. Each year, the fighter market brings in over a billion dollars to the electronics industry

PLANS TO PHASE in interceptor missiles over the next five or six years (40 percent manned interceptors and 60 percent guided missiles by the mid 1960's, according to USAF's Gen. Irvine, Deputy Chief of Staff, Materiel) should not affect the billion dollar figure for manned interceptors. The increasing sophistication of electronic gear in these planes is continually upping the dollar business volume.

Over half the number of aircraft ordered by both Air Force and Navy are interceptors. Of the 979 aircraft USAF plans to buy in fiscal 1959, 546 are fighters, 88 are bombers (39 of which will be B-52's), 107 transports, 185 trainers and 49 miscellaneous.

Navy will buy more than 700, about half of them carrier-based interceptors.

Here's what the Air Force and Navy buy and spend in this area:

USAF, last year, spent close to $1.34 billion for interceptors. Estimating that 30 percent of an interceptor's cost is for electronics (although various

Air Force and Navy officials have pegged the percentage at from 25 to 65) USAF spent $402 million in fiscal year 1958 for airborne electronic equipment for interceptors.

Major electronic subsystems for fighters include airborne-armament control, bombing, toss bombing, navigation, flight control, communications and electronic counter-measures.

Navy, as of June 30, had on order flyaway interceptors for carriers amounting to $1.17 billion—30 percent, or $351 million of this, for electronics.

Electronic ground support equipment for USAF's 28 interceptor wings is valued at $70 million—$2.5 million per wing. Although Navy's figures for carrier-based gear are classified, the value is probably more than double that of USAF's. Navy currently has about 37 fleet aircraft carriers and 66 smaller escort carriers.

Major categories of ground support equipment are surveillance radar, communications, check-out and data reduction equipment. The continual replacements, up-dating and modifications of this gear represent a large and steady business.

An electronic computer helped Lockheed's engineers come up with the technique for breaking the world altitude record of 91,249 ft on May 7 with USAF's F-104A Starfighter. First climb pattern called for the zoom-to-height to start at 55,000 ft. When the problem was put to the computer, however, its answer was "start at 45,000 ft." The new approach did it.

Though dollar figures for electronic subsystems in air-to-air guided missiles are unobtainable, this portion of the fighter market is easily a multimillion-dollar-a-year business.

Navy has at least eight interceptor models carrying Sidewinders (GE and Philco), three that use Sparrow I (Sperry) and three armed with Sparow III (Raytheon). Air Force fighters carry Hughes' Falcons, the atomic Genie (guided by a Hughes armament control system) and the Sidewinder.

A new air-to-air guided missile carrying an atomic warhead will be developed by Hughes for North American's Mach 3 interceptor, the F-108, according to Lt. Gen. Donald L. Putt, USAF Deputy Chief of Staff for Development.

USAF's seven "Century" series interceptors and modified versions are being primed by five companies: North American (F-100, F-108), McDonnell (F-101), Convair (F-102, F-106), Lockheed (F-104—see cover) and Republic (F-105).

Nine Navy models and variations are primed by two of the above companies, says the Bureau of Aeronautics: North American (FJ-4B) and McDonnell (F3H-2, F4H-1) and by three others: Chance Vought (F8U-1, F7U), Douglas (F4D-1, F5D-1) and Grumman (F11F-1, F9F-1, F9F-8).

Many of the eight primes listed above design and develop some of the electronic subsystems that go into their planes. Most of the major subsystems are subcontracted to electronics companies.

Airborne-armament control systems for fighters alone represent a large business. A definitive list of armament control producers, however, is complicated by two factors: The systems are sufficiently complex to bring in several companies to work on a single system. (System for Lockheed's F-104 is a CFE, "contractor furnished equipment", development with RCA, GE and Aerojet-General as major component suppliers.) Also, two different systems may be used in two versions of the same model fighter. (Hughes built the system for the McDonnell F-101 and GE for the F-101A.)

Besides the F-101, Hughes systems, according to Air Materiel Command, are used in the F-102, F-106 and will be used in the F-108. Portions of the system for McDonnell's F3H are also built by Hughes.

General Electric furnishes armament control and flight control systems for Republic's F-105. Most recent contract for this work amounted to $4.6 million.

Sperry has entered the flight control field for interceptors with a $3 million contract for Navy's Mach 2 Crusader III, the Chance Vought F8U-3.

Bombing-navigation system for the F-105 is a CFE development with Autonetics div. of North American. Packard-Bell recently won a $1 million contract for the communication and navigation packages for Crusader I.

Type navigation system selected for interceptors depends on the plane's mission. Short range objectives require little craft-to-ground reference. Main requirement is craft-to-target. Air defense interceptors such as the F-102 and F-104 are guided to their enemy targets by SAGE system command signals from the ground. Long-range weapons, such as fighter bombers, may use Doppler and/or inertial. A Kollsman star tracker will go in the F-108.

Chance Vought's vice-president W. P. Thayer says the trend in navigation equipment for interceptors is tied to a compromise. "The inertial-stellar systems which are desirable, are in general too bulky. The electronics industry needs to miniaturize such systems and improve reliability to be attractive for use in manned interceptors." Thayer also urges the industry to keep the airframe industry and the government up to date on the level of progress being made. "Without close liaison, the worth of an advancement will often be lost by virtue of its untimely incorporation," he says.

Photoelectric relay helps set up newsprint roll, as . . .

Electronics Grows in Printing

Composition, press work and handling all provide lengthening lists of electronic applications as newspaper publishers face up to economic problems of slow-growing revenue, fast-growing costs

GROWING importance of electronics to newspaper manufacturing was much in evidence at the recent American Newspaper Publishers Association's Mechanical Conference at Atlantic City, New Jersey.

Three manufacturers introduced electronically controlled d-c press-drive systems. The d-c press drive systems provide smooth acceleration, deceleration and pushbutton control of press speeds through use of silicon and ignitron rectifiers.

These electronic developments, discussed recently, are only a small part of the total contribution electronics makes toward putting out daily newspapers.

In the last five years, many papers have installed electronic photocomposition systems. One is at the *New York Times*.

In one electronic photocomposition system, characters are first selected from a typewriter keyboard. Every time a key is punched an electron-tube controlled light beam shoots out and at the right instant, catches the desired character from a whirling disk and projects it onto a film. A photoengraving is then made from the film. Primary use of these systems is in advertising composition.

Some 6,000 newspapers, particularly the smaller ones, are using electronic scanning systems for photoengraving. Scanners for preparing color-corrected negatives and computer-controlled color correctors for preparing color plates are being increasingly used.

In addition to press-drive controls, the press room depends on electronics for color registration controls. More and more use of color registration controls is expected as newspapers increase their use of color ads. The press room also depends on electronics for fully automatic pasters for newsprint splicing; web controls to prevent sidewise motion; static eliminators; newsprint moisture meters; ink-flow controls and dielectric ink dryers; conveyor drives for handling newsprint rolls; and for counting press runs.

In newspaper assembling, handling and delivery operations, conveyor drives, counting equipment, section stuffers, bundlers and wrappers, copy counters and addressers make use of electronics.

The spanking new plants of the *Sun-Times* in Chicago and the *Globe* in Boston make heavy use of electronic equipment. These plants are representative of the trend towards more use of electronics in newspaper manufacturing.

Electronic communications and controls are the technical heart, lifeblood and brains of the $5-million *Chicago Sun-Times* building.

Hundreds of thousand of dollars of electron-tube controlled equipment is used. Equipment includes thyratron controlled printing presses (see cover). Thyratrons also control conveyors carrying the completed newspaper from presses to mail room.

For newsprint handling, photoelectric cells auto-

matically kick off the 1,500-lb rolls from their carriers at preselected points. In the mail room electronically controlled inserting machines put five supplements into the mainsheet in one operation.

Sun-Times shop superintendent Fred Liebherr sums up the electronics industry's contribution to modern journalism this way: "Each of our major press units can turn out 52,000 copies of an 128-page paper per hour. This represents a 33½-percent production increase over what we could do before the move to our new building. Electronics has played a big part in achieving this increase."

At the new $12-million Boston Globe plant, $500,000 of electrical and electronic controls harness the power of rotary-web color presses which can print 55,000 papers per hour.

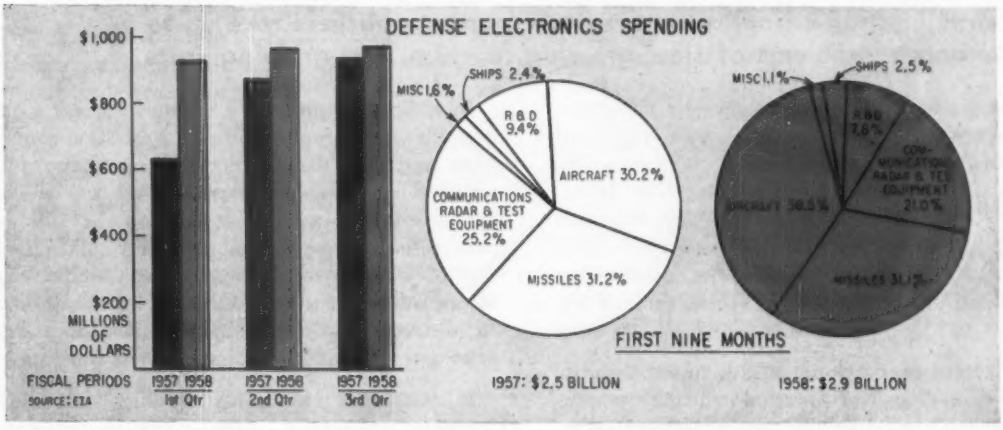
Each of six panels which control the press units have six water-cooled ignitron rectifier units. Stations are interconnected with the adjustable voltage electronic rectifiers which supply armature voltage to d-c drive motors.

Photoelectric relays for switching reels of newsprint eliminate human judgment in putting new reel into position.

When new reel has attained proper speed, onlight notifies pressman who can then throw switch to make the splice (see photo).

A recent ANPA survey reports 415 dailies plan to spend $62.9 million in 1958 for plant expansion and new equipment. The same 415 paper group spent $87.3 million on plant expansion last year. The trend today, however, is towards spending larger sums for plant expansion. Some 585 dailies spent only $40.6 million for new plants in 1953, another ANPA survey found.

PRODUCTION and SALES



Defense Spending 17% Ahead of Year Ago

DEFENSE ELECTRONICS spending in the first nine months of fiscal 1958 topped last year's similar span by 17 percent, or almost $412 million. Total for the period ending March 31 was $2.863 billion, compared with $2.451 billion for the 1957 period.

Total amounts spent on main product categories were:

	1st 9 mos. (millions $)	
	1957	1958
Aircraft Electronics	$741	$1,045
Missile Guidance	775	891
Communications, Radar & Test Equipment	617	601
Research & Development	221	222
Marine Electronics	58	72
Miscellaneous	39	32

Aircraft electronics' share increased from 30.2 to 36.5 percent as that segment moved into the number one spending slot. Missile guidance dropped to second place, although its share declined only slightly from 31.2 to 31.1 percent. Both the radar, communications and test equipment and R&D categories declined in relative importance. R, C & TE's share dropped from 25.2 to 21.0 percent. R&D's portion fell from 9.4 to 7.8 percent.

Quarterly electronics spending for the entire group of categories increased steadily in the first three quarters of 1958 and bettered comparable 1957 quarters in every instance. Totals in fiscal 1958 increased from $926 million in the first quarter to 967.5 million, second quarter, to $969.5 million, third quarter.

What's Your Firm Worth?

The problem of evaluating an electronics firm often stumps the experts. Most valuations are made on basis of price-earnings ratios. But there is more. Here are some principles to use as a guide

"How do you value a small electronics firm?" asked one of the owners of a components manufacturing firm at a management conference the other day.

Setting a price on their companies is a problem likely to confront owners of electronics firms at least once in their business life-span.

In many cases the problem arises from merger offers. In others it arises when the firm plans its first public securities sale. If one owner dies, the U.S. will often value the company in setting estate taxes.

Valuation of an electronics firm is regarded as one of the knottiest of business problems. Here's what a dozen industry leaders, financial and valuation experts told Electronics about it.

"You can't set up a blueprint", was their almost unanimous answer. "Valuing an electronics firm is 90 percent judgement and 10 percent facts and figures," they said. "Even after using your best judgment, horse trading may completely alter the price."

One principle is to reserve decisions on actual price until after a general investigation is made. The investigation, says a representative of Lehman Brothers, New York investment bankers, takes a hard look at the field of product activity, management ability and technical ability.

Buyers want to know if the firm being sold is engaged in a fast growing area of the industry.

"I look for a management team with at least one person capable of carrying the ball in research, manufacturing, marketing and finance, particularly finance," says a representative of a N. Y. C. bank.

To rate a firm's technical ability, financial men frequently hire an electronics expert.

After the general investigation comes the hard part: arriving at a dollar-and-cents value.

Evaluation that starts by considering price-earnings ratios of comparable-risk firms is easily the most popular method. There seems to be little support for adding up asset values when placing a value on an electronics firm. Reason is that buying an electronics firm involves buying future earnings which may have little or no relation to present assets.

The price-earnings method puts a value on the earnings of a company equal to the price security markets are paying for earnings of similar companies. It works this way, explains the valuation firm of Ford, Bacon & Davis:

A stock is selling for $45 and with annual earnings of $3 per share. Its price-earnings ratio is 15. Assume the firm is identical in every way with the company to be valued. If the company makes $200,000 a year, its value at 15 times earnings is $3 million.

Practically, there are never two identical companies. Adjustments have to be made for factors such as size of company, number of products and outside financial sources, among other things.

A firm just getting started with sales of couple of hundred thousand is not worth the same price-earnings ratio as an established firm with sales of $10 or $20 million, says Hardie Shepard of Payson & Trask, a venture capital firm. Similarly, a firm with only one product is a greater risk and worth less than a firm with several products.

Today most electronics firms sell at between 6 and 25 times earnings. However, sales at 30 times and over have occurred.

Generally, highest price-earnings ratios are paid for system and instrument manufacturers. This group commands ratios of 15 to 1 and up.

Price-earnings ratios for components manufacturers is reported to be between 6 and 15.

Companies having sales of $100 million and up sometimes sell at around 10 times earnings since financial experts often feel such firms have achieved most of their growth.

After arriving at a value based on price-earnings, adjustments may have to be made for special contingent liabilities like contract renegotiation proceedings and patent infringement suits. Also considered may be special tax benefits from tax-loss carryovers and accelerated depreciation rights. Also, are inventories and accounts receivable properly valued?

But there may be considerations more important. In the case of mergers, "Is it one in which 2 plus 2 equals 5 or 6," says William H. Burgess, president of Electronic Specialty, West Coast manufacturer. And "Is it (a merger) in which you feel that the two managements can live and get along with each other?" asks Don Miller of Airborne Instruments Lab., div. of Cutler-Hammer.

Of course, there are more questions. Ask them all. And most important, answer all.

Manpower: Tightening Up?

Defense money bumps up hiring of engineer manpower. It hasn't hit 1956 levels yet, but a lot of people think it will in the fall. Meantime, screening procedures remain stiff, costs mount

SOFTEST part of the engineer manpower market has already been reached by the electronics industry.

Although it's still fairly easy to hire engineers, especially recent graduates, all the signs point to increased tightness in the coming months. Principal reason: post-sputnik defense spending, just now filtering down to industry as obligated hard money.

"Electronics is leading the pack," says William Cavanaugh of New York's Engineers Joint Council. He told ELECTRONICS that the "proportional impact of defense spending for engineering prototype work is greatest in electronics."

In Los Angeles, May and June saw classified advertising for engineers almost quadruple. Airframe manufacturers and missilemakers are drawing heavily on electronics manpower reserves in the West. In Chicago, demand for electronics engineers has trebled in the last 90 days and is still rising.

Most personnel men expect "a certain softness" to continue for a month or so, perhaps through the summer. Management will not raise its procurement sights until money is there to back it up. But the money is coming.

"You've got to remember that electronics has merely retrenched from an extremely high level to one that's lower but still high," says a placement bureau official at an eastern university. "Of our engineering graduates, all but about 10 percent had jobs or firm offers by June 1. That's more than just the cream of the crop, you know."

Engineering manpower market began to soften in the wake of last year's defense cutbacks. Employment slid downward through the winter. In the spring, reverberations from sputnik began making themselves felt in the form of contract awards.

"Within the next six months," comments Cavanaugh, "I expect the market to tighten up again."

Chief engineers and personnel officers in industry agree on several major points:

• **Many of the men currently on the street** are there for a reason. "As many as 8 out of 10 are dead wood," estimates the chief engineer of a medium-sized Philadelphia firm; the problem is to find the live ones.

• **Experienced engineers** for front-of-the-field work are still hard to get. Demand for creative and capable men is high, and there are few "floaters" in this category. One of the nation's largest professional placement services, points out that "changing jobs just isn't popular" in a soft market such as currently exists.

• **Good graduates** are still in demand. The ratio of experienced to inexperienced engineers hasn't changed; both were cut back about 60 percent during the worst months of the winter.

• **Cost of procurement** has gone up. Electronics firms spend $5-10,000 to hire a $20,000-a-year man, about $1,000 to put a new graduate on the payroll.

Company personnel policies sometimes put firm's worst foot forward. Many application blanks aren't keyed to engineers; some personnel men don't give prospects a clear idea of what job they have in mind, don't answer questions, don't hesitate to inconvenience prospects. Result is that an engineer who's already working has serious second thoughts about changing.

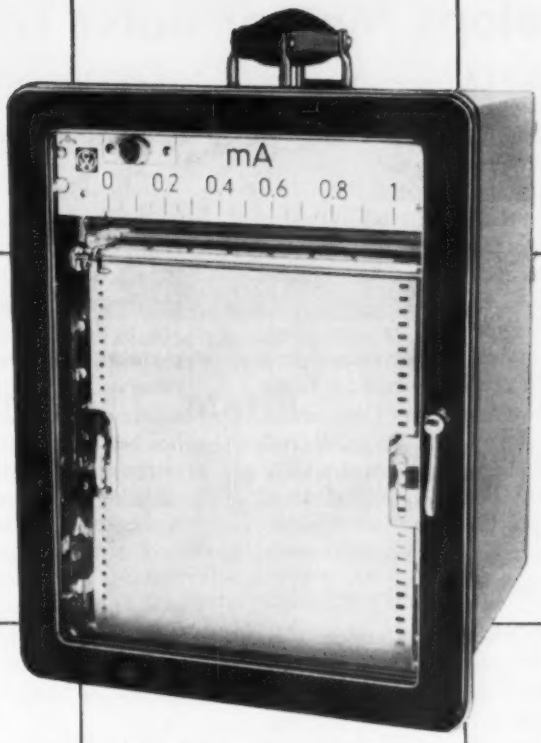
Screening methods may affront the man who is well qualified and knows it. But screening is nonetheless stricter today as companies try hard to net the exceptional man from among the other fry.

During the tight-market period, engineers were hired if warm and breathing, their records and references checked afterwards. "We discovered," says one chief engineer, "that warm bodies aren't too productive; we'd rather have cold, calculating ones." Today almost all firms check before hiring, follow a man's career all the way back to college, talk to everybody he's known and worked with.

One chief engineer always surprises an additional professional reference out of an applicant when he's not expecting it, then checks that one very carefully. "Through careful screening," he adds, "we got only one lemon in twenty engineers hired last year."

Buyers' market in manpower hits hardest at the inexperienced man. Planned continuity of young blood, part of the hiring policy of many firms, absorbs many new grads. But there are still some January and June bachelors looking for jobs. "They're mostly the ones," comments a Cleveland personnel man acidly, "who think they can move into a chief's job right out of the fraternity house."

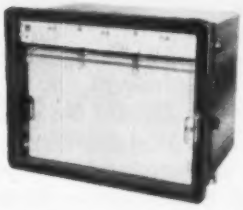
Millivolt Recorder with self-balancing DC amplifier. 2-5-10-20—50-100-200 mv ranges. 1.5% accuracy except 2mv range (2%.)



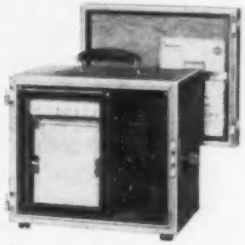
Strip Chart Recorder, standard model 81 (portable) and 82 (flush) are also available for wall and projection mounting. Weighs only 19 lbs. and measures 7½" x 9⅞" x 8½".

$445.00

Operations Recorders with 4, 8 or 16 pens which register independently the on-off time of machinery. Each track can be a different ink color.

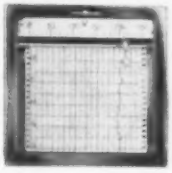


Double size recorder models, take up to six multiple, independent movements. Wall and projection mount available.



Universal AC-DC Recorder with total of 23 ranges. Complete in solid oak case, 13¾" x 11¾" x11" . . . weighs 36 lbs.

Miniature Slim Recorder model saves half the width of standard recorders. Only 3$^{13}/_{16}$" x 7½" x 8⅝".



Miniature Square Model Recorder, in flush mount, 5$^{11}/_{16}$" square x 13" deep.

Curtiss-Wright RECTILINEAR STRIP CHART RECORDERS

Curtiss-Wright recorders, DC preamplifiers, and controllers, can be combined into systems to meet varied demands.

Backed by a leading West German maker's **50 YEARS** of precision instrument manufacturing

A rare combination of precision and ruggedness . . . straightforward in design and simple to operate . . . these new Curtiss-Wright precision instruments are made through a licensing agreement with Metrawatt AG, one of the most experienced of West German precision instrument makers.

Important features include: *Rectilinear Recording • Inkless and Ink Recording in One Unit • Three-Speed Transmission plus 60:1 Speed Change • 1% Accuracy • Shock, splash and dustproof.* The complete line includes double size and miniature sizes; AC, DC, power and combination movements; wide choice of ranges and chart drives. Write for full information.

ELECTRONICS DIVISION

CURTISS-WRIGHT

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ENGINEERING REPORT

Navy Develops Meteor Burst Transmission

METEOR COMMUNICATIONS system is being developed by the Navy for special duty. Last month Howard E. Chubb, of the U.S. Navy Electronics Laboratory, San Diego, Calif., reported on the Navy's work in this field to the IRE's 2nd National Convention on Military Electronics in Washington, D. C. He said tests so far indicate that such a system, requiring complex equipment, would have a number of advantages, including security, in augmenting standard Navy communications. A mobile unit now is being tested at a Stanford University site; traffic is being exchanged with a fixed station at San Diego. The Navy expects to test the unit at sites 700 and 1,100 mi north of San Diego, and aboard a ship. Chubb says a storage device using digital techniques and circulating delay lines, and capable of storing 2,500 bits, is under development, along with transistorized control circuitry.

ELECTRICAL ENGINEERS out of college this year seem to be in as great demand as ever. Lehigh University reports its 44 EE seniors sat for 317 job interviews and got 127 offers. Average starting salary is $485, a drop of $3 from last year. M. S. grads start at an average of $556. Lehigh says EE's are getting $11 a month more than the average for all engineering grads, although the average is up to $474 from $465 a year ago.

MOLECULAR SPECTROGRAPH developed in East Germany is being hailed there as an important new research tool in biochemistry and organic chemistry. Prof. M. von Ardenne reports that the Dresden Molecular Spectrograph is able to register weight differences, even of molecules based on hydrogen, at molecular weights of more than 1,000. This promises to aid developments in plastics, pharmacy, macromolecular chemistry, and in petrochemistry. Mass spectrography with chemical molecules had long been impossible because of the splitting of the molecules by the ion sources, says von Ardenne. He says this problem has been licked after 10 years of R&D by a new electronically created ion source that overcomes the short lifespan of negative ions. Recently, Arthur von Hippel of MIT called for emphasis on "molecular engineering." Said von Hippel: "Instead of taking prefabricated materials and trying to devise engineering applications consistent with their macroscopic properties, one builds materials from their atoms and molecules for the purpose at hand."

SPUTNIK III scientific apparatus is operated automatically by a programming device made entirely of semiconductors, reports Pravda. Soviets say total number of semiconductor elements used in the satellite's electronic devices is "several thousand." (See Foreign Business, p 33).

TECHNICAL DIGEST

• **Star follower** on 18½-inch telescope at Dearborn Observatory uses pyramid-shaped mirror to split light from star into four beams going to four multiplier phototubes. These connect to Brown servo-amplifiers driving carriage motors of photographic plate holder. Position of star on plate is maintained within 0.0001 inch for exposures up to several hours. Mirror is polished stainless steel.

• **Two-transistor** long-wave receiver for delegates at international conferences has six-detent tuning knob giving original speech and translations in five other languages. Channels are in range from 65 to 400 kc. Single transmitting antenna loop surrounding entire auditorium serves all six channels. As made by Siemens & Halske, Vienna, receiver is hung on neck strap and has single 1.3-v nickel-cadmium cell. First transistor is in reflex circuit to give three stages of amplification.

• **Helix waveguides** that serve as mode filters in 18-inch lengths and provide continuous filtering in 112-inch lengths have been made by Bell Labs as attractive new component for wide-band microwave transmission in range from 35 to 75 kmc. Helix is close-wound on 2-inch steel mandrel with No. 37 plastic-insulated wire. Three layers of epoxy-impregnated woven glass fiber cloth are wound and cured over this, followed by a lossy jacket of a few turns of tin-oxide coated glass fiber cloth and protective layers of plain glass cloth with epoxy to give a rigid waveguide.

• **Acoustical lens** mounted in front of new Siemens & Halske, Munich, tweeter broadens radiation pattern to approximate that of associated low-frequency loudspeaker. Lens consists of multiplate grid that refracts sound waves outward just as concave glass lens spreads light rays.

• **Scintillator detector buttons** made by NBS from polystyrene or other organic plastics give greater efficiency because they can be made thicker yet still remain transparent. Former inorganic phosphor buttons become opaque with increasing thickness, thereby weakening penetrating neutron pulses.

Specially designed trailer houses complete electronic gear for vibration tests of DC-8. Operator monitors 17-inch scopes which display response of 36 vibration pickups

Jet Vibration Tester Is Mobile

SPECIAL MOBILE electronic system has been developed for vibration testing the new DC-8 jet airliner. The test equipment is housed in a trailer so that it can be brought to the site to test the complete aircraft.

Primary reason for going to the mobile test lab is increased accuracy, although convenience plays an important part. Former methods involved bringing equipment piecemeal to the aircraft site. Probability of inaccuracies from temporarily connecting a large number of separate pieces of gear for the tests is felt to be greater.

Testing fully fueled aircraft added to the problems. This testing, required because fuel weight alters aircraft dynamic response, must be done outdoors. This required another temporary setup. Test conditions may be different in that different pieces of equipment may be used, adjustments may vary, cables length may change.

Ling Electronics designed the trailer in close cooperation with Douglas, maker of the DC-8. The system was originally designed specifically for this aircraft.

The system provides a source of vibration, monitors response to the vibration and presents and records results. A low-frequency oscillator generates a sine wave, the frequency of which can be controlled by the operator. Six 250-watt amplifiers deliver the sine wave to loudspeaker-like shakers.

The electrodynamic shakers have an armature shaft with a maximum stroke of 3 . . . inches. Rods are connected to the shafts and directly to the airframe.

Each of the twelve shakers can transmit a force of 70 pounds over the frequency range from 0.25 to 300 cps. The operator can control the amplitude of vibration of each shaker.

The shakers are arranged to simulate conditions to which the aircraft may be subjected, such as take-off, landing or wind gusts. Response of the aircraft is picked up by transducers.

A master switch is provided to couple all shakers simultaneously. This permits damping characteristics to be monitored as the plane returns to equilibrium.

Monitoring is accomplished with oscilloscopes and oscillographs. Two five-inch scopes act as the masters. Two 17-in. oscilloscopes are slaved to the master scopes.

Signals from the transducers are fed to the oscilloscopes through two electronic switches. On switch samples twelve of the transducers and the other twenty-four. Twelve signals are fed to one scope and twenty-four to the other.

By adjusting the bias controls built into the electronic switches, the operator can arrange the presentations of the sampled signals in any desired pattern on the scope face. The instrumentation patch board permits the operator to choose which signals are to be displayed.

Permanent records are made with a four-channel recorder. Recorder signals are first fed to amplifiers which increase level to a usable range.

MEETINGS AHEAD

July 16-18: Forestry Conservation Communications Assoc. (FCCA), Ninth Annual Conf., Parker House, Boston, Mass.

Aug. 1-3: Texas Electronic Clinic and Fair, Statler-Hilton Hotel, Dallas, Texas.

Aug. 6-8: Special Tech. Conf. on Nonlinear Magnetics and Magnetic Amplifiers, AIEE, Hotel Statler, L. A.

Aug. 13-15: Conf. on Electronics Standards and Measurements, AIEE, IEE, NBC, National Bureau of Standards Labs., Boulder, Colo.

Aug. 13-15: Seventh Annual Conf. on Industrial Applications of X-ray Analysis, Denver, Colo.

Aug. 18-23: International Conf. on Semiconductors, International Union of Pure and Applied Physics, Rochester, N. Y., Contact: M. H. Hebb, GE, P.O. Box 1088, Schenectady, N. Y.

Aug. 19-22: Western Electronic Show and Convention, Los Angeles, Calif., WESCON, IRE, WCEMA, Pan Pacific Auditorium, Ambassador Hotel, L. A.

Aug. 26-Sept. 6: British National Radio Show, Radio Industry Council, Earls Court, London.

Sept. 3-5: Application of Electrical Insulation, First National Conf., AIEE, NEMA, Cleveland, Ohio.

Sept. 12-13: Communications Conf., IRE, Sheraton Monrose Hotel, Cedar Rapids, Iowa.

Sept. 15-19: Thirteenth Annual Instrument-Automation Conf. and Exhibit, ISA, Philadelphia Convention Hall, Pa.

Sept. 22-24: National Symposium on Telemetering, Americana Hotel, Miami Beach, and Patrick Air Force Base (Sept. 25).

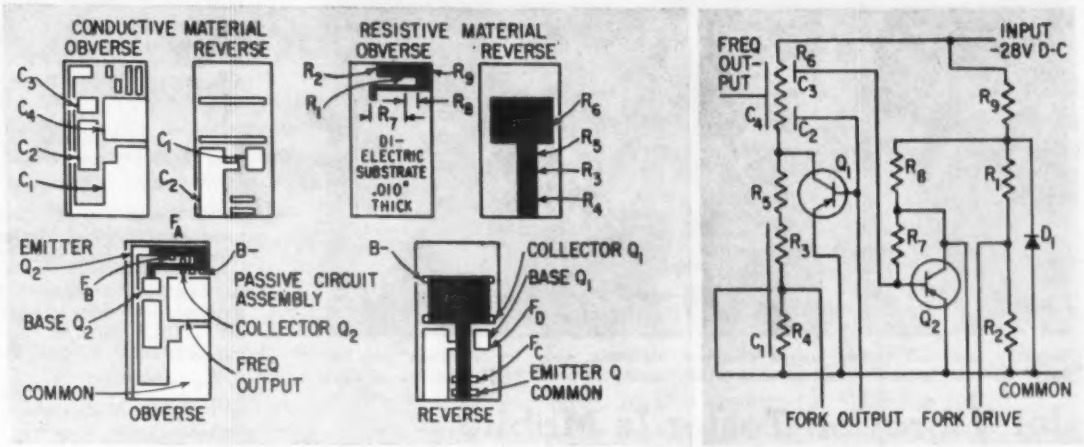
Sept. 24-25: Seventh Annual Symposium on Industrial Electronics, Rackham Memorial Auditorium, Detroit, Michigan.

Oct. 1-2: Radio-Interference Reduction, U. S. Army Signal Research & Devel. Labs., IRE, Armour Research Foundation, Chicago, Ill.

Oct. 6-7: Symposium on Extended Range and Space Communications, IRE and George Washington Univ., Lisner Auditorium, Wash., D. C.

Oct. 8-10: IRE Canadian Convention and Exposition, Electronics and Nucleonics, Exhibition Park, Toronto, Canada.

Oct. 13-15: National Electronics Conf. 14th Annual, Hotel Sherman, Chicago.



Components merge in a tuning fork oscillator on a dielectric substrate, pointing a way to . . .

One-Step Circuit Production

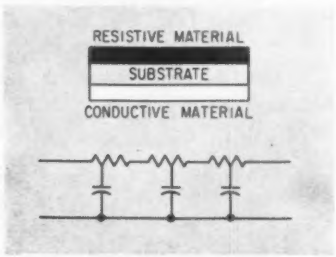
Navy sponsors research in production of miniature circuits by vacuum deposition

SEVERAL TYPES of electronic components are produced by vacuum deposition of metals. Merging individual components into circuit functions made from original materials in a vacuum chamber is called feasible in reports just made available by Varo Manufacturing Co.

The firm completed a feasibility study for the Navy a year ago and has since received R&D contract renewals extending through 1959. The aim is automatic production of reliable, miniature circuit units.

A number of these "microcircuits" have been made, including R-C filters, carrier generators, bistable multivibrators and d-c amplifiers, with all but the transistors, input and output leads and substrates vacuum deposited.

An R-C filter is made, for example, by depositing resistive material on one side of the dielectric substrate and conductive material on the other side. The substrate itself provides the capacitance.



Microcircuitry resistor-capacitor network and equivalent circuit

Transistor circuits are similarly made after transistors are soldered in place. While resistive material is being deposited, the circuit is activated and its frequency monitored. When desired frequency is reached, deposition is stopped.

In time, firm feels, transistors or filamentless tubes can also be made during the process. Fabrication of potentiometers, transformers, memory cells and semiconductors, as well as resistors and capacitors, is documented in technical literature.

One circuit form could consist of a slab of germanium with junctions printed or alloyed in. Other circuit values would be provided by alternate deposition of dielectric, conductive, resistive and connective materials.

Alternatives could be three-dimensional mosaics with insulating or conductive interfaces between active masses of material or a waffle-like substrate with active materials patterned in the holes.

According to Dale Fuller, Varo's director of research, the basis for automatic production is ionizing the metal vapor so it is readily collected on charged substrates. The vaporized metals are alloyed while in the gaseous state.

Present research is directed at avoiding masking by controlling the beams of ionized metals. It may be done by deflection yokes which would make the production machinery equivalent to a cathode ray tube. Eventually, the yoke would be controlled by programming.

No real attempt has been made by Varo, Fuller says, to exploit the miniaturization which deposition makes possible. However, the method eliminates such structural items as inter-component connections, individual supporting dielectrics and housings. Densities of circuits made to date range from 800,000 to 1.4 million components per cubic foot.

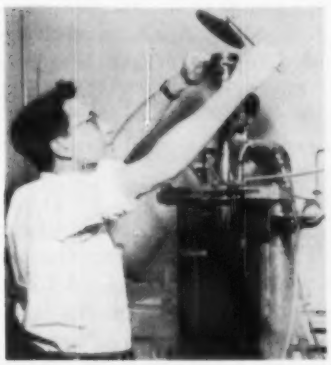
Reliability, Fuller says, is intrinsic. Factors are: fractioning off of material impurities during vaporizing, reduction of solder connections, forming and sealing the circuit while it is still in a vacuum and uncontaminated.

English Silicon Process Licensed

NEW GRADE of ultra-high-purity silicon, produced by thermal decomposition of silane, is being made commercially by du Pont. The firm has acquired exclusive U.S. and Canada rights to the process developed by Standard Telecommunications Labs, of Eng-

land, an IT&T affiliate.

Du Pont reports the process yields silicon of the exceptionally high purity required for such components as high voltage rectifiers and power transistors. High power devices often require boron impurity levels below one-half part per billion. Impurities would cause the devices to break down at high voltages.



Zirconium zinc gives unexpected results when placed in a cryostat

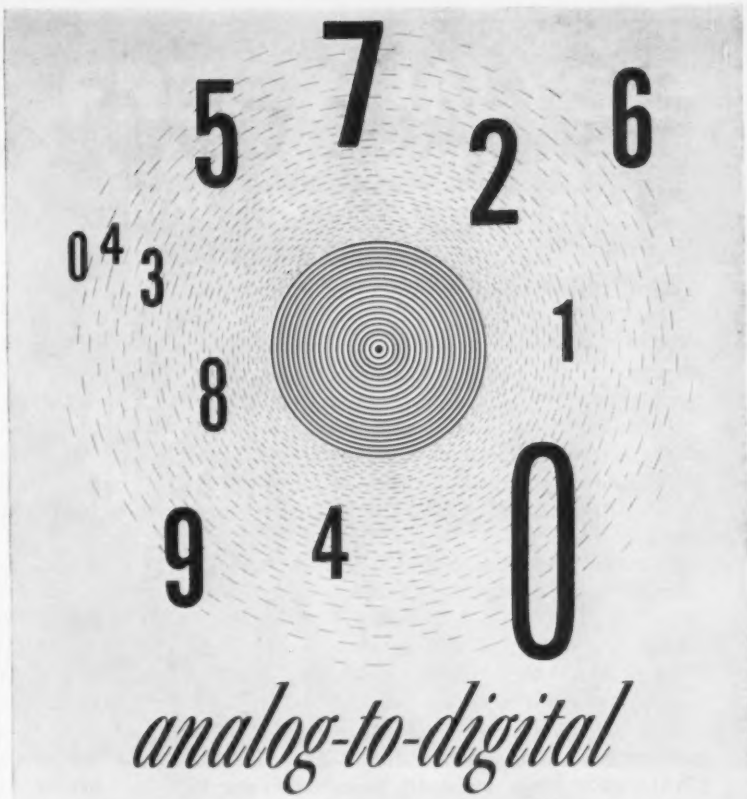
Nonferrite Is Ferromagnetic

FERROMAGNETISM at low temperatures has been discovered in an intermetallic compound which does not contain any of the commonly known ferromagnetic elements.

Investigation of zirconium zinc ($ZrZn_2$) by B. T. Matthias at Bell Labs indicates that ferromagnetic and perhaps antiferromagnetic compounds may be formed by the combination of many more metals than had been supposed until now.

Previously known ferromagnetic intermetallic compounds contained some iron, cobalt, nickel, chromium, manganese or rare earths. This has led to the assumption that a ferromagnetic compound had to contain at least one strongly paramagnetic element.

At 35K temperature, zirconium zinc's ferromagnetic characteristics are of the same order of magnitude as conventional ferrites at room temperature. The discovery is expected to aid fundamental studies of magnetism.



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KEARFOTT DIRECT DRIVE ADAC is a shaft-positioned analog-to-digital device utilizing coded drums, interconnected by high-speed odometer type gearing to provide an electrical impulse representing shaft position. Available for a wide variety of capacities and codings.

KEARFOTT MECHANICAL COUNTERS are used to provide precise visual presentations of angular position, latitude, longitude, or any information imparted by shaft rotation. Both types are designed to provide long life at maximum slewing speeds up to 1800 R.P.M.

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MILITARY BUSINESS

First SAGE Center Opens

Thirty-five more coming, plus constant updating, promise continuing business for electronics industry

FIRST SAGE direction center—the electronic brains of America's air defense system—officially went into operation at McGuire AFB, N.J., on June 27.

Thirty-five more SAGE centers are in various stages of construction and, according to Gen. Earle E. Partridge, supreme commander of NORAD, North American Air Defense Command, will be in operation by 1961.

Detection and warning systems which feed data into SAGE include the three northern radar fences—DEW Line, Mid-Canada Line and Pine Tree Line—offshore and inshore radar picket ships, Texas towers, Navy blimps, USAF and Navy reconnaissance aircraft and gap filler radar located along the coasts.

Two defense measures currently get information transmitted automatically from SAGE. They are USAF fighter wings and Army Nike-Ajax missile installations. Soon to strengthen this defensive force are Army's Nike-Hercules and USAF's Bomarc missiles and more USAF interceptor aircraft.

Among the 65 prime contractors in this multi-million dollar business, according to USAF's listing released at the June 27 ceremonies, are:

Lincoln Labs at MIT: design and development of SAGE, which was launched in 1949.

Western Electric: weapons systems manager and contracting agent for Bell Telephone Labs; design and construction of direction center and combat center buildings; coordination of all installation and test activities; scheduling and budgeting of all components of the system; development of basic communications plans; engineering-coordination; and testing of system equipment.

IBM: Heart of the SAGE system is IBM's $27 million AN/FSQ-7 computer. (Each center uses two.) IBM field engineering for SAGE includes about 1,500 employees.

Burroughs: Data processing equipment, AN/FST-2, on the Texas Towers.

General Electric: Power supply for SAGE computers; FPS-6 height finding radar; airborne search radar, AN/APS-20E, for Lockheed Super Constellation; automatic data link system, AN/GKA-4 Flight Control Group, which transmits data from SAGE to USAF interceptors.

Bendix: Long-range early warning radar, AN/FPS-20, on land and on Texas Towers; automatic gap-filler radar AN/FPS-14; airborne early warning radar; and input system for IBM's electronic computers.

System Development Corp.: SAGE computer programming and training.

Lewyt: Transistorized indicator that displays and provides a printed record of air defense data.

MILITARY ELECTRONICS

• **Work is scheduled** to begin immediately on a radio-radar network capable of detecting and tracking any satellite or space object attempting a furtive pass across the continental U.S.

The Advanced Research Projects Agency, in conjunction with the National Advisory Committee for Aeronautics and the National Science Foundation, has assigned construction and operation of Minitrack stations at San Diego, Calif., and Blossom Point, Md., to the Naval Research Laboratory. The Ballistic Research Laboratories will build and operate a c-w Doppler complex of stations in Fort Worth, Texas, and New Mexico. One outlying receiving station connected with the Fort Worth complex will be erected at White Sands, New Mexico, and a second one about 200 mi east of White Sands.

• **A new satellite tracking** technique, using three or four Doppler stations located 100 miles apart, will be tested when the next U.S. satellite goes up. Under the direction of ARDC's Electromagnetic Radiation Laboratory, Air Force Cambridge Research Center, the stations will be located at Fort Benning, Ga., Craig AFB, Ala., Naval Air Station, Pensacola, Fla., Tyndall AFB, Panama City, Fla.

Doppler data from the stations will be processed by an electronic computer. Radiation Lab engineers believe the satellite's orbit parameters can be determined to within a few percent, based on information from one satellite passage.

CONTRACTS AWARDED

Lockheed wins a $7.5 million contract with the Army for a new series of recoverable target missiles called Kingfisher. Launched from a B-50 aircraft, the 38-ft ramjet bird travels at Mach 2 plus. Guided during flight by ground radio, the Kingfisher can record theoretical hits and near misses by using Lockheed's firing error indicator.

Raytheon gets a $15 million contract with BuShips for 1,365 radio communications relay sets, AN/TRC-27.

Lear gets a $4.1 million contract with the Army Signal Corps for automatic flight control systems to be used in Army's H-34 helicopter. Also, a $842,302 contract with Air

Materiel Command for control assembly and attitude gyros for use in the F-105 and F-106 aircraft.

North Electric is awarded two Signal Corps contracts totaling $8,767,000 for the manufacture of telephone switchboards and communications equipment.

Sylvania receives a $2,634,000 contract with the Army Signal R&D Laboratory for "continuation of development work in electronics" that began six years ago. Also, a $320,000 contract with Air Materiel Command for ecm attachments to the AN/GPS-T2 radar target simulator.

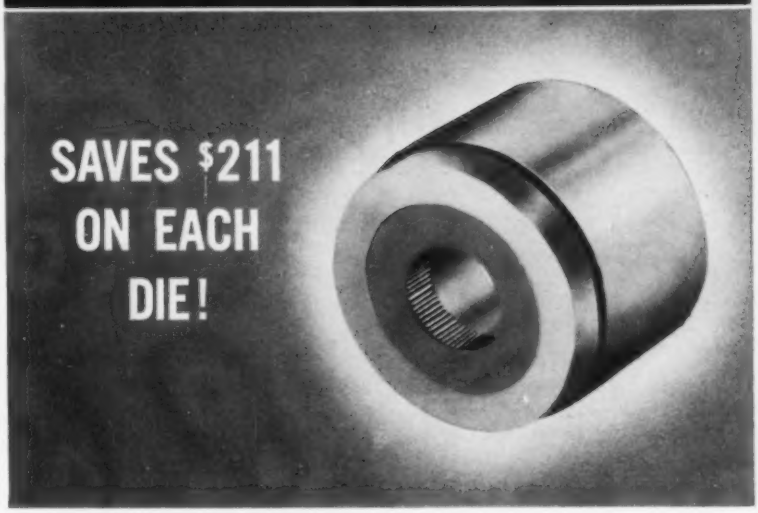
General Precision Laboratory wins a $3,971,963 supplemental contract with the Airways Modernization Board for the transition and terminal portion of an experimental Air Traffic Control Data Processing Central. Equipment used will include computers, controller consoles, flight-strip printers and display equipment. Subcontractors to GPL will be: Link Aviation, Librascope and Tasker Instruments. GPL also gets a $1,343,820 contract with AMC for antennas, receiver-transmitters and computer-frequency trackers for APN-81 for B-52 and KC-135 aircraft.

Siegler will provide closed circuit tv systems amounting to $600,000 to Radioplane for Army surveillance drones. Siegler also will produce additional magnetic amplifier autopilots for Martin's Mace missile, amounting to $560,420.

GE gets a $3,999,291 contract with Rome AF Depot for radar course directing group, AN/GPA-73.

Sperry gets two contracts with BuOrd for production of guided missile equipment. A $19 million contract is for production of radar sets AN/SPG-55, special field test equipment, and related spare parts. The radar will go on Terrier guided missile ships. An $8 million contract is for manufacture of long lead-time items for radar sets AN/SPG-56 to be used with the Talos guided missile program.

FREE ANALYSIS
OF YOUR DIFFICULT MACHINING PROBLEMS



PROBLEM: reduce costs of machining this carbide knurling die. **SOLUTION:** A **Raytheon Impact Grinding Analyst** recommended producing the serrated portion of the die with a Raytheon Impact Grinder. **RESULT:** the die, formerly made by conventional methods and costing $265 each is now produced for $54—saving $211 per die.

HOW YOU CAN BENEFIT—

Whatever your difficult cutting, slicing, drilling, engraving or shaping problems in hard or brittle materials—carbides, ceramics, semi-conductors—a Raytheon Ultrasonic Impact Grinding Analyst stands ready to help you solve it—without cost or obligation. For full details, mail the coupon below—today!

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TO RAYTHEON MANUFACTURING COMPANY
COMMERCIAL EQUIPMENT DIVISION
INDUSTRIAL PRODUCTS DEPT. EC7
WALTHAM 54, MASS.

☐ Please send me literature on Raytheon Impact Grinders.

☐ Please have a Raytheon Impact Grinding Analyst contact me.

My problem is: (describe metals or non-metals involved, tolerances, etc.)

_____

_____

NAME_____

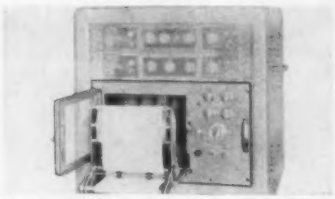
COMPANY_____

ADDRESS_____

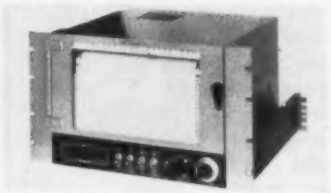
CITY_____ STATE_____

Chart Recorders Make News

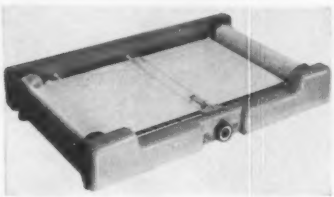
Massa Laboratories, Inc.
12-channel recorder



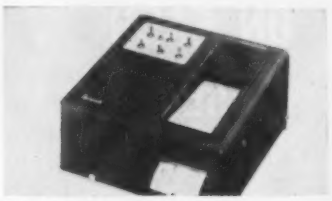
Edin Co., Inc.
rectilinear recorder



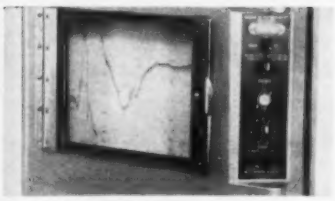
F. L. Moseley Co.
strip chart recorder



Sanborn Co.
recording chart viewer



Brush Instruments
direct writing oscillograph



Bludworth Marine
hydrographic survey recorder

STRIP CHART RECORDERS have come into their own in the missile age. The new recorders shown provide quick and reliable information in the lab and field testing of telemetering and other systems.

Massa Laboratories, Inc., 5 Fottler Rd., Hingham, Mass., (50) announces a new 12-channel rectilinear recorder featuring true motion with excellent transient response—free of resonant peaks, overshoot and ringing. Frequency range is d-c to 200 cps and it records with ink or electric writing.

In production at **Edin Co., Inc.**, 207 Main St., Worcester 8, Mass., (51) is a 12¼ in. high rectilinear recorder that writes on true rectangular coordinates for ease of examination. Available with from two to six recording channels, it features flat frequency response to 70 cps. It will faithfully record almost any known phenomena.

F. L. Moseley Co., 409 N. Fair Oaks Ave., Pasadena, Calif., (52) has available model 80 transistorized strip chart recorder, a general-purpose recording instrument designed especially for laboratory use in applications requiring strip form records in a variety of chart speeds.

Now being manufactured at **Sanborn Co.**, 175 Wyman St., Waltham 54, Mass., (53) is a new oscillographic recording chart viewer that provides variable chart drive speeds from 15 ipm to 100 fpm, and accepts charts up to 16 in. wide and 200 ft. long. It has a direction-reversing switch and automatic braking.

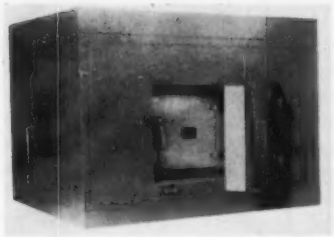
Brush Instruments, 3405 Perkins Ave., Cleveland 14, Ohio, (54) has developed a two-channel direct writing oscillograph featuring extra high chart speeds of 625 and 1,250 mm per sec. When signals are changing too rapidly for accurate analysis, the instrument stretches out recording for better chart interpretation and permits precise time correlation between two phenomena on adjacent channels.

A lightweight portable hydrographic survey recorder is reported by **Bludworth Marine**, 1500 Main Ave., Clinton, N. J., (55). Model ES-130 weighs less than 40 lb, has a depth range to 245 ft with four scale ranges of 65 ft each.

For more information use READER SERVICE Card

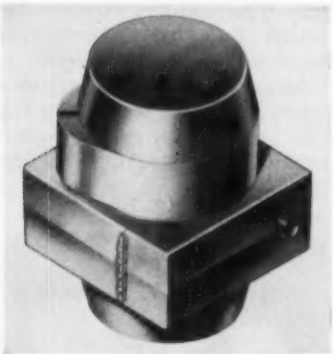
Tuning Fork
precision standard

VARO MFG. CO., 2201 Walnut St., Garland, Texas. Model 6250 tuning fork has passed required vibration and temperature tests to qualify for the satellite instrumentation program. In less than 1⅝ cu in., it provides an accurate impulse which gives the recorded information a time base, materially aiding in the study of the data. Accuracies to 0.01 percent in tuning forks from 300-4,000 cycles are in constant production. Applications are varied in the electronics field. The tuning fork is used as a source for a reference frequency to use in measuring unknown frequencies. For ruggedness and accurate precision frequency regulation, it is in constant demand. A new use is with data link and selective calling systems feasible because of the high Q characteristics. **Circle 56 on Reader Service Card.**



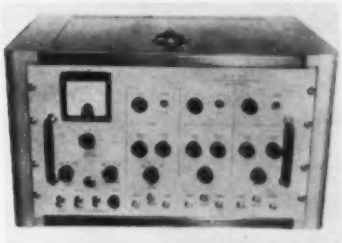
Test Chamber
anechoic type

INDUSTRIAL ACOUSTICS CO., INC., 341 Jackson Ave., New York 54, N.Y. The Mini-Sized anechoic test chamber provides controlled acoustical conditions for sound measurements of small mechanical and electronic devices. Designed for a low frequency cut-off of 250 cps, the portable chamber can be used for determining acoustical characteristics of miniature radio, and audio equipment; for free field calibrations of hearing aids and loudspeakers; for analysis of noise in such equipment as fractional horsepower motors. **Circle 57 on Reader Service Card.**



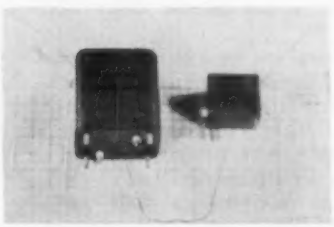
Radiation Shield
stacked sections

BAIRD-ATOMIC, INC., 33 University Road, Cambridge 38, Mass. Model 800D low background shield is composed of four separate stacked sections to form various complete units for thin-window flow counting, Geiger and scintillation counting. Within this building block construction, it provides a minimum of three inches of iron shielding in all directions. Unit measures 13¾ in. high by 10¼ in. wide by 10¼ in. deep. The shield is designed to hold the model 821B Geiger or proportional flow counter or the model 822A sample holder with Geiger tube. **Circle 58 on Reader Service Card.**



Radar Test Set
simulates targets

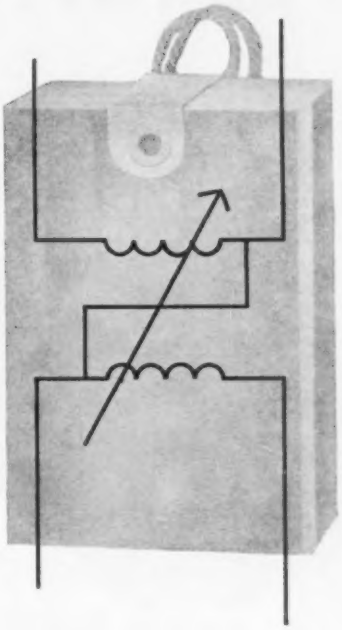
REMANCO, INC., 128 Broadway, Santa Monica, Calif. The RP375 is an ideal tool for simulating multiple radar target situations. It also provides a single target, at the true radar range, for two or three nonsynchronous radars. It is especially adaptable to radar countermeasures work because of the variety of target combinations and the provision for mixing both low and high frequency noise signals with the video output. The unit may also be used as a pulse code generator or as a general purpose precision multipulse generator. Range positioning accuracy is 0.5 percent of the full scale range, and range rate accuracy is 0.25 percent of the selected value. Price is $2,850. **Circle 59 on Reader Service Card.**



Tiny Filters
narrow passband

BULOVA WATCH CO., Electronics Div., Woodside 77, N. Y., announces type 2E2SM6 narrow passband filters. In bandwidths from 20 cps to over 1 kc, they can be made with a shape factor (60/6 db) of

NO BRUSH PROBLEM



You get . . .
Greater Reliability
From G-E Inductrol*
Voltage Regulators

There are no brushes to worry about on the G-E Inductrol regulator. Because it is a brushless induction device, this highly reliable voltage regulator is far easier and more economical to operate. There are many more advantages, such as high overload capabilities and accurate, drift-free control (just set it and forget it), that you'll want to know about.

For more information, write Section 425-11, General Electric Company, Schenectady, N. Y.

*Registered trademark of General Electric Company for Induction Voltage Regulators

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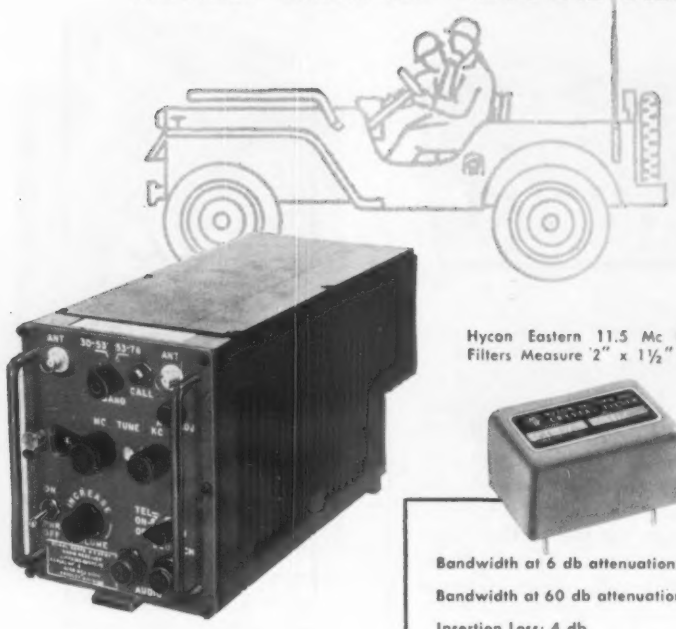
CIRCLE 11 READERS SERVICE CARD

FIRST 920 Channel Single Conversion VHF Mobile Receiver Uses HYCON EASTERN CRYSTAL FILTER



VHF, 920 Channels, fully transistorized Radio Receiver by Avco Mfg. Corp., Crosley Division

Hycon Eastern 11.5 Mc Crystal Filters Measure 2" x 1½" x ¾"

Bandwidth at 6 db attenuation: 33 Kc

Bandwidth at 60 db attenuation: 60 Kc

Insertion Loss: 4 db

Ultimate attenuation: 80 db

Mobile communications for today's fast moving military operations require equipment which is rugged, compact, highly accurate and dependable. Filling this need is the Avco-Crosley, fully transistorized, 920 channel, mobile VHF-FM Radio Receiver incorporating a Hycon Eastern 11.5 Mc Crystal Filter and matching Discriminator.

The use of only one frequency conversion provides excellent image rejection in combination with high adjacent channel selectivity. By eliminating multiple conversions, cross modulation and receiver desensitization are reduced even in the the presence of strong interference from any of the other 920 channels.

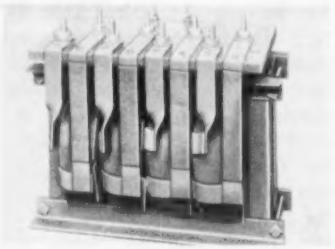
High Frequency Crystal Filters for mobile applications offer the advantages of small size, freedom from microphonic behavior, and ability to maintain their characteristics throughout the entire temperature range of −60°C to +90°C. Hermetically sealed, no realignment or readjustment is ever required.

There are Hycon Eastern Crystal Filters designed to solve selectivity problems in AM or FM receivers and SSB transmitters, whether fixed or mobile. Hycon Eastern engineers can assist you in choosing filter characteristics best suited to your needs. Write for Crystal Filter Bulletin.

HYCON EASTERN, INC.

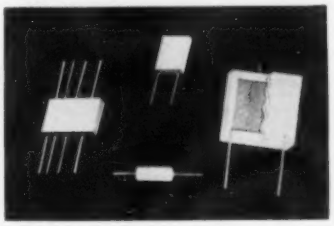
75 Cambridge Parkway Dept. A Cambridge 42, Mass.

3.5 to 1. Insertion loss (dependent upon bandwidth) can be as low as 1 db, while the ripple in the passband is less than 1 db. Drift is less than 10 cycles over the temperature range of 0 C to 75 C. Size of the package is 1⅜ in. by 1⅞ in. by 1⅛ in. Type 2ESM6 fulfills the need for frequency selective filters in communications, telemetering and radar information devices. **Circle 60 on Reader Service Card.**



Transformer filament type

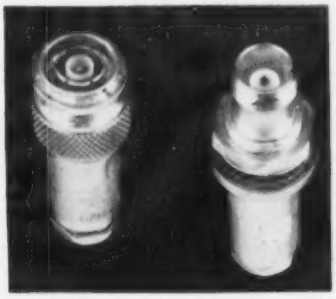
NOTHELFER WINDING LABORATORIES, INC., P. O. Box 455, Trenton, N. J., has available a special filament transformer, 400 cycles, with 4 secondaries, 10 v at 100 amperes each. Every secondary can be mounted in parallel series, or series parallel. The extremely close tolerance between secondary potentials under load is most important in this design.



Fixed Resistors bobbinless

CHICAGO TELEPHONE SUPPLY CORP., Elkhart, Ind. A new line of smaller, modular, permanently stable, 100 percent tested, low temperature coefficient bobbinless precision wire fixed resistors exceed the proposed MIL-R-93B spec. Floating element construction firmly embeds resistance elements

and contacts in epoxy resin, reducing space factor and eliminating wire strain, bobbin and winding form. Design flexibility permits grouping many resistors in a single unit. **Circle 61 on Reader Service Card.**



Connectors small, rugged

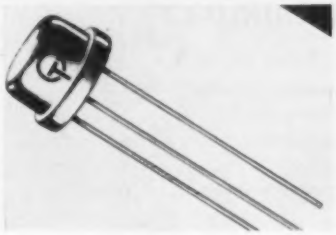
KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, N. Y. The TNC series connectors feature a positive-locking threaded type of coupling. Coupling nuts are conveniently provided with lock-wire holes for additional security and will withstand the most severe vibration without danger of uncoupling. The connectors are impedance matched for 50 ohm cables such as RG-55A/U and RG-58C/U. Types are available for RG-59/U, RG-62/U, RG-71/U and other small size cables. All contacts are gold plated with female and outer contacts fabricated of beryllium copper and heat treated to assure permanent electrical continuity. **Circle 62 on Reader Service Card.**

Connectors taper-contact

THE DEUTSCH CO., 7000 Avalon Blvd., Los Angeles 3, Calif. Taper-pin receptacles replace the solder-pots in a newly developed miniature, environmental connector. This taper-contact connector meets or exceeds the requirements of MIL-C-5015 and is available in 3, 7, 12, 19, 27, 37 and 61 contact arrangements. All plugs in the series are available with the push-pull locking mechanism. Pin retention in the taper-contact termination is 15 lb ± 3 lb. **Circle 63 on Reader Service Card.**

Trimmer Pot half-in. size

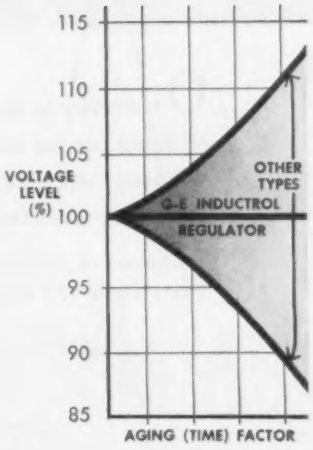
THE GAMEWELL CO., Newton Upper Falls, Mass., has available a new ½-in. trimmer potentiometer. It meets applicable MIL specified environmental conditions, and is available from stock for operation at maximum temperature at 150 C. Designated RVG-8T, the pots are stocked in resistance ranges of 20 to 50,000 ohms but are available up to 100,000 ohms. Resistance tolerance of ± 5 percent and linearity of ± 3 percent are produced with windings on both cards and mandrels. **Circle 64 on Reader Service Card.**



Transistors bilateral types

GENERAL TRANSISTOR CORP., 91-27 138th Place, Jamaica 35, N. Y., has available five new bilateral tran-

NO DRIFT PROBLEM



You get . . . Assured Accuracy From G-E Inductrol* Voltage Regulators

With the G-E Inductrol regulator control, voltage is automatically held to within ±1% bandwidth. Unique compensating controls on the G-E Inductrol regulator make it unnecessary to continually reset voltage level. You merely set it at the desired voltage level, and forget it. This highly reliable and accurate automatic control is also compensated for temperature, and is inherently insensitive to frequency or power factor changes.

For more information write Section 425-12, General Electric Co., Schenectady, N. Y.

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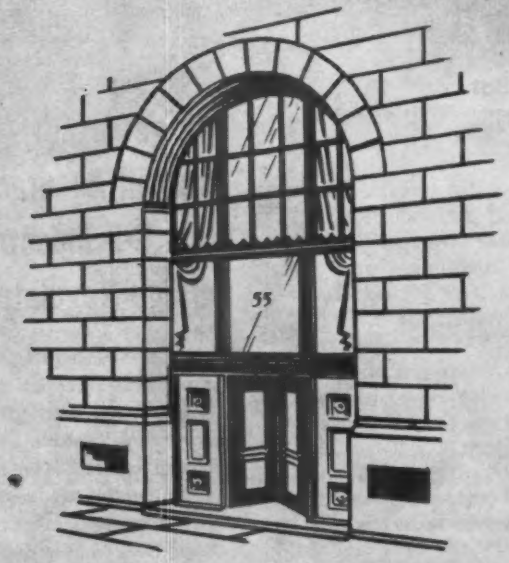
Our service is tailored to provide all the working capital any qualified client needs, without increased borrowing, diluting profits or interfering with management.

Information available for any manufacturer or distributor with $500,000 or more annual sales.



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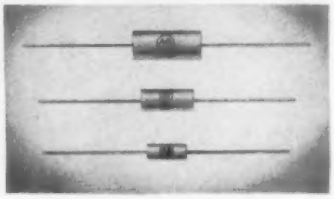
Providing operational financing for the apparel, electronics, furniture, leather, plastics and textile industries.

Subsidiaries:

T. B. C. Associates, Inc., New York Southwest Texbanc, Inc., St. Louis

sistors, types 2N592 through 2N596. Available in the JETEC 30 welded case, these germanium alloyed junction units are particularly useful in bilateral medium and high speed switching applications. All units can be supplied in full compliance with MIL-T-19500A. **Circle 65 on Reader Service Card.**



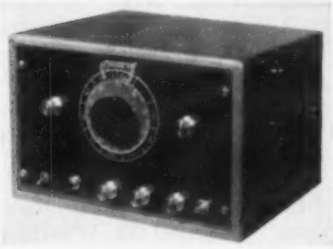
Precision Resistors metal alloy grid

ALLEN-BRADLEY CO., 136 W. Greenfield Ave., Milwaukee 4, Wis. A new line of hermetically sealed, precision resistors use a specially designed metal alloy grid resistance element assuring excellent h-f characteristics. They are available in three types: the CAH, 0.25 w; the EAH, 0.50 w; and the GAH, 1.0 w, with full ratings at 100 C ambient temperatures. Standard resistance tolerances are 0.1, 0.25, 0.5 and 1.0 percent. In all tests, these resistors exceed MIL specifications for wire wound and metal film type precision resistors. Stability under load is excellent and the percent change in resistance with varying temperature does not exceed ± 25 ppm per deg C from the value at 25 C. **Circle 66 on Reader Service Card.**

Photo Cell high sensitivity

RADIO CORP. OF AMERICA, Harrison, N. J. The 7163 is a cadmium-sulfide photoconductive cell de-

signed for use in street-lighting control and other light-operated relay applications in industry. Direct relay operation, without the use of an amplifier, is possible in most applications because of its extremely high illumination sensitivity. Spectral response covers the approximate range from 3,300 to 7,400 angstroms. Maximum response occurs at about 5,800 angstroms. The 7163 is enclosed in a metal envelope with glass window and is hermetically sealed. Minimum photosensitive area is 0.54 in. by 0.65 in. **Circle 67 on Reader Service Card.**



Pulse Generator fast rise times

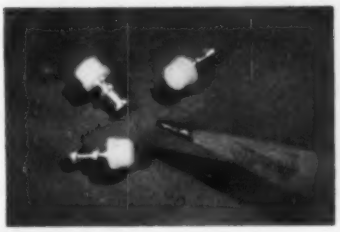
RADIATION INSTRUMENT DEVELOPMENT LABORATORY, INC., 5737 S. Halsted St., Chicago 21, Ill., announces a mercury pulse generator for testing amplifiers, pulse height analyzers and other applications where fast rise times, various exponential decays and a wide range of positive or negative pulses are required. Output pulse height is variable from 100 μv to 100 v; shape: exponential rise to exponential decay; rise time: better than 5×10^{-8} variable over a range of 1,000 to 1. Decay time constant is 1, 2, 10 or 100 μsec. **Circle 68 on Reader Service Card.**

Power Converter d-c to d-c

LA ROE INSTRUMENTS, INC., 1709 BE. Montgomery Ave., Rockville, Md., has available a transistorized d-c to d-c power converter. Input is 6 to 32 v d-c; output, d-c to 5,000 v; power, to 1 kw; environmental specifications, −55 C to +85 C. It meets all applicable ground, missile, airborne and CAA specifications for shock and vibration. Unit cannot be damaged by short circuit or overloaded output. **Circle 69 on Reader Service Card.**

Transistor Checker battery operated

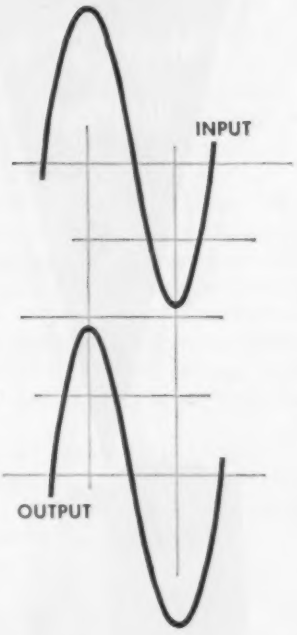
VALOR INSTRUMENTS, INC., 13214 Crenshaw, Gardena, Calif. A compact, inexpensive transistor checker provides instantaneous go no-go check. Both standard JETEC base and power transistors may be plugged in. In addition, the checker may be used for measuring leakage currents and breakdown voltages as well as identifying transistor type. **Circle 70 on Reader Service Card.**



Teflon Standoff for thin chassis

SEALECTRO CORP., 610 Fayette Ave., Mamaroneck, N. Y. A subminiature Teflon standoff terminal (ST-SM-51-TUR-L2) has been developed for use in a larger mounting hole in a thin chassis of say 0.048 in. thickness. To add to its strength heavier post diameters and larger turrets are used. The Teflon insulation provides a voltage rating of 750 v rms and flashover at 3,000 v rms at sea level or 1,300 v rms at 50,000 ft, at a temperature range of − 55 C to + 200 C. **Circle 71 on Reader Service Card.**

NO WAVEFORM PROBLEMS



You can . . . Simplify Design Circuitry With G-E Inductrol* Voltage Regulators

The G-E Inductrol voltage regulator does not introduce harmful waveform distortion in your circuits.

Because it's an induction device, this voltage regulator offers you the advantages of brush-free operation . . . no voltage drift and tubeless control. Result: the ultimate in reliable voltage control.

For more information write Section 425-16, General Electric Company, Schenectady, New York.

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the New
MODEL ST-6
VARITRON

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Removable Automatic Electric Magazine

Choice of Lenses in Focusing Mounts

Holds up to 100 ft. of 35 mm Roll Film

Rugged
Reliability
AT LOW COST

For more information write to

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CIRCLE 16 READERS SERVICE CARD

Literature of the Week

MATERIALS

Printed Circuit Cleaner. Emkay Chemical Co., 319 Second St., Elizabeth, N. J. Technical data sheet No. 201 discusses the appearance, chemistry, reaction, application and advantages of Rexoclean PCT, a new printed circuit cleaner. **Circle 72 on Reader Service Card.**

COMPONENTS

Military Rectifiers. International Rectifier Corp., El Segundo, Calif. No. RN-458 of *Rectifier News*, a bimonthly publication, announces a new service department to assist engineers in the design and procurement of military rectifiers. Included is an article on prescribed reliability. **Circle 73 on Reader Service Card.**

Terminal Strips. Vector Electronic Co., 1100 Flower St., Glendale 1, Calif. Bulletin 63 illustrates and describes a line of terminal strips for a multitude of circuitry applications. Specifications and ordering information are given. **Circle 74 on Reader Service Card.**

Tube Guide. Westinghouse Electric Corp., P.O. Box 284, Elmira, N. Y., has available a new 20-page booklet which provides an easy guide for industrial and special purpose type Reliatron tubes. **Circle 75 on Reader Service Card.**

Waveguide Components. D. S. Kennedy & Co., Cohasset, Mass. Duplexers, horns, bends, straight sections and other components for large size waveguide are described in a new short form catalog. **Circle 76 on Reader Service Card.**

EQUIPMENT

Audio Control. Electronic Systems Engineering Co., 903 Cravens Bldg., Oklahoma City 2, Okla. Bulletin LE-201 describes the uses of models LE-2 and LE-3 Limpander automatic audio control and noise suppression amplifiers. **Circle 77 on Reader Service Card.**

Compatible SSB. Kahn Research Laboratories, Inc., 22 Pine St., Freeport, L. I., N. Y. A four-page illustrated brochure containing technical specifications describes a compatible single-sideband system for a-m broadcasting applications. **Circle 78 on Reader Service Card.**

Connector Selector. DeJur-Amsco Corp., 45-01 Northern Blvd., L.I.C. N.Y. A slide rule type calculator, providing complete electrical and mechanical specifications on all standard series Continental connectors is now available. **Circle 79 on Reader Service Card.**

Environmental Test Instrumentation. The Bristol Co., Waterbury 20, Conn. Bulletin W1831 outlines indicating, recording, programming and controlling instruments for environmental test equipment. **Circle 80 on Reader Service Card.**

Microwave Stability Tester. Laboratory for Electronics, Inc., 75 Pitts St., Boston 14, Mass. Model 5004 microwave stability tester is described in a 4-page folder. Detailed specifications are included. **Circle 81 on Reader Service Card.**

FACILITIES

Resistor Facilities. Mepco, Inc., Morristown, N. J. A four-page brochure contains extensive illustrations of the design, engineering, production and quality control facilities at its 30,000 sq ft resistor plant. **Circle 82 on Reader Service Card.**

Temperature Devices. Fenwal Inc., Pleasant St., Ashland, Mass. Complete facilities for the design and manufacture of temperature controls, detectors and indicators are described in a new 30-page brochure. **Circle 83 on Reader Service Card.**

Reds Boast of Solar Battery

Russians laud development which made new telemetry power source available for third sputnik

TELEMETRY SYSTEM of Russia's third sputnik is being described by Soviet scientists as "improved considerably" over the systems used in their first two satellites. Keys to the system are silicon solar cells whose development began only three years ago after Soviet scientists had seen technical papers written by American scientists.

In discussing their solar batteries the Soviets give the impression that there is a race underway with Western scientists to better the efficiency of such devices. They appear to have more ambitious plans for solar batteries in space, perhaps in connection with a space platform.

"The solar battery on the third sputnik will enable scientists to study in detail its performance in conditions of space flight," Pravda said recently. And Tass quoted Prof. Yevgeniy Fedorov as saying that solar batteries similar to those carried by Sputnik III would ultimately become the main source of power in space travel.

Each silicon cell on Sputnik III reportedly produces about 0.5 volts, with the coefficient of transformation of solar energy at 9 to 11 percent.

Komsomolskaya Pravda reported that the Soviet all-union institute for power-source research, in collaboration with the Lebedev physics institute and the semiconductor institute, began work on a solar battery as much as three years ago.

"Such batteries already existed in a number of countries," the paper allowed, "but their efficiency was almost negligible—only two or three percent of the solar energy was converted into electricity." Actually, Bell Telephone Laboratories announced its solar battery in April 1954 with a six percent efficiency.

One year later, when the Russians began their concerted effort, Bell announced it had achieved 11 percent efficiency. Commercially available devices made by other firms under license have been rated at 10 percent efficiency, with some new experimental units understood to be higher than 11 percent. However, U.S. firms have concentrated on making their devices more practical and cheaper rather than on raising efficiency.

An article in a Soviet Navy magazine has just reported that a solar battery of 10 percent efficiency and one square meter in size produces 100 watts, enough to power a series of instruments. In 1955 Bell Labs reported that cells of 11 percent efficiency could delivery power from the sun at the rate of up to 100 watts per square yard of silicon surface.

The Russian author, Engr. Vice-Adm. Ya. Varaskin, stated that the solar battery on Sputnik III is made up of nine sections. Four, he said, are mounted on the forward underside, four on the rear underside and another on one side. This arrangement, Varaskin explained, guarantees normal operation regardless of the satellite's position.

DEVELOPMENTS ABROAD

• **Russian scientists** are reportedly working on a universal information machine that will store blocks of paper sheets containing coded data. Logical and linguistic systems to permit the machine to "read" the information have not yet been developed. Laboratory apparatus answers eight questions fed into it by a telephone dial device; answers appear on a tv screen in either stationary or moving text. Also reported: a new type of memory system based on rapid action magnetic ferrite elements which record in code a book's contents.

• **West German** customs authorities in Hamburg have just put into service an anti-smuggling x-ray truck. The mobile unit was developed by Rich. Seifert & Co. of Hamburg, in cooperation with the Federal Finance Authority in Bonn. X-ray is rated at 260,000 volts, 5 milliamps, and permits cases 40 by 40 by 40-in. to be radiographed with ease. Another radiograph unit is in the Hamburg customs office and will also be delivered to Frankfurt customs men; rating is 120,000 volts, 5 milliamps, powerful enough to inspect parcels 15 by 15 by 40-in.

EXPORTS and IMPORTS

In Tokyo the Ministry of International Trade and Industry is reported to be studying applications from 24 tv stations to import television equipment. Gear wanted amounts to about $1 million, of which $375,000 is for seven video tape recorders. Applications include microphones, measuring equipment, projectors and other items that would be imported from the U.S.

In Britain an experimental all-transistor tv receiver has been devised by Mullard Ltd. Scan magnification reportedly results in a 100

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to 1 power saving in horizontal circuits and a 4 to 1 saving in the vertical plane for a 17-in. screen. Firm says commercial receiver on the same principle is some years away; designers expect to reduce the number of transistors used from 42 to 30. Total power consumed in present model is about 12 watts, provided by a 12-volt battery measuring 6.5 by 2.5 by 3-in.

Europe's importance as an electronics market was underscored last month by an international conference held in Brussels by RCA. President John L. Burns and other top officials met with the heads of associated companies in Britain, Italy, Spain and West Germany; European managers of the RCA Service Co. and RCA Communications, and record distributors from 14 countries. Conference discussed the company's activities under the common market and plans to introduce its new stereophonic records to European manufacturers.

In Jamaica eight new Marconi vhf multichannel units will provide a link between Kingston and Montenago Bay. The installation will operate in the 150 to 230 mc band; it will provide 24 channels initially, but the equipment can permit twice as many when needed. The Automatic Telephone and Electric Co. Ltd. supplied the channeling equipment.

Montreal firm Canadair Ltd., is purchasing an instrumentation system worth about $250,000 from Consolidated Electrodynamics Corp. The system will flight-test the Canadian firm's CL-28 long-range submarine-hunting aircraft, and its CL-44 long-range and CL-66 medium-range turboprop transports.

Japanese Atomic Energy Commission has purchased an analog computer valued at $158,730 from Electronic Associates, Inc.

In Italy Burroughs Italiana, wholly owned Burroughs subsidiary, is expanding from Milan headquarters with sales and service facilities in Turin, Rome and Padua.

Tape, Disks Run Radio Station

Broadcasters study automatic programming gear which is basis of new operating method

NEW IDEA currently gaining interest among radio broadcasters is automatic station operation.

• **Problem:** Find an automatic way to process, file and play the many records and transcriptions that make up the major portion of a station's stock in trade. One estimate says 90 percent of program fare is recorded.

• **Solution:** Prerecord announcements and commercial messages. File program material in mechanized selector racks. Punch a few yards of paper tape to control record sequence. Sit back and push buttons.

To prerecord announcements, a new type of disk is now available. It resembles a 7-inch 45-rpm record and consists of a plastic base coated with oxide such as used on magnetic tape. It is magnetized by a cartridge mounted on a record tone arm which moves along a spiral groove. Due to large dimensions of the groove, playing time for the magnetic disk, which rotates at 33⅓ rpm, is 70 seconds a side. This provides one minute of usable time and five seconds before and after announcements. The disk can be erased and used over again.

Keystone of the automatic system using these disks is a 23-button tape puncher. As program schedules are prepared, they are coded on paper tape. Information punched tells what record should be played and where it is. At air time, the tape is started through a reader which has no physical connection with the puncher. It may be located anywhere in the studio. Sequence of the tape governs sequence of the program. The reader generates control pulses which are fed to a rack-mounted mechanical memory unit. This unit activates either of two automatic record selectors equipped with turntables.

One selector contains magnetic disks, the other holds conventional 45 rpm records. Both selector mechanisms house 100 records stacked radially on the periphery of a rotating circular rack.

The rack mechanism, receiving instructions from the memory unit, rotates until the selected disk is next to the turntable. An arm removes the disk from the rack and sets it down ready for playing. The 45 rpm selector/turntable sells for $1,385. Its magnetic disk counterpart costs $1,850.

Equipment to "cut" the magnetic disks lists at $995. Tape puncher and readout come to $6,630, including the mechanical memory unit.

While no plans are yet underway to market magnetic disks and players as consumer items, RCA, manufacturer of the automatic programming equipment, says such could happen at a future date.

FCC ACTIONS

• **Advises** proposed rulemaking to provide that only A1 emission may be used in lower 100 kc of the 50 to 54 and 144 to 148 mc ham band.

• **Informs** associations which own private automobiles that future applications for channels in the Land Transportation band will no longer be exempt from frequency coordination requirements. New frequency availabilities make exemptions no longer applicable.

• **Amends** Maritime rules to permit transmitters leased by the same lessor and licensed before Jan. '59 to be excepted from spurious emission and type acceptance limitations until after June 1, 1963.

• **Makes** editorial changes in rules governing shipboard stations to include a current list of public coast stations allowed to communicate on 2,638 kc.

• **Denies** petition from American Radio Relay League asking that all applicants for ham licenses who live within 125 miles of an FCC examination point take their tests under Commission supervision. Separate rulemaking provides that holders of Novice, Technician and Conditional licenses must take FCC supervised tests.

• **Invites** comment by July 14 to proposal to add channel 12 to Pembina, N. D., which does not now have an assignment.

STATION MOVES and PLANS

WTEU, Wetumpka, Ala., receives increase in power from 1 to 5 kw on 1,250 kc.

KDMA, Montevideo, Minn., is granted change of facilities from 1,450 kc 100 w U, to 1,460 kc 1 kw U.

WJQS, Jackson, Miss., gets approval on renewal of license application.

WPEG, Arlington, Fla., files for c-p to install new transmitter.

KJOE, Shreveport, La., applies for permission to up power from 1 to 5 kw, change antenna-transmitter

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location, install new equipment, delete remote control operation of transmitter.

WAIM, Albion, Mich., seeks c-p to increase power from 1 to 5 kw, install directional antenna daytime and new transmitter, make changes in ground system and studio location.

WHK, Cleveland, Ohio, requests permission to determine operating power by direct measurement of antenna power.

KURY, Brookings, Ore., applies for license to cover c-p authorizing new standard broadcast station.

KLGN, Logan, Utah, files for c-p to change hours of operation from daytime to unlimited, install directional antenna for nighttime use.

WEDK, Springfield, Mass., City School Committee applies for c-p authorizing new noncommercial educational f-m station.

WKAI, Macomb, Ill., transfers license from Macomb Broadcasting Co. to WKAI Broadcasting Co. Consideration, $79,000.

KOOO, Omaha, Neb., license passes from Central Plains Broadcasting to KOOO Corporation. Consideration, $200,000.

KULA-TV, Honolulu, Hawaii, is granted assignment of license to Kaiser Hawaiian Village Tv, Inc., for $685,000 on condition that Kaiser dispose of interest in KHVH-TV, Honolulu, prior to acquiring KULA.

KTJS, Hobard, Okla., slated for July 28 hearing continuation on a-m application.

WDTV, Christiansted, Virgin Islands, asks for extension of time on c-p authorizing new standard broadcast station.

KQXR-FM, Bakersfield, Calif., seeks c-p to change location, decrease antenna height from 360 to 156.5 ft above average terrain, delete remote control operation.

Expedites P-C Production

A NEW PLANT with large capacity for manufacturing printed electronic circuits will soon be in production in Chicago.

Over 600,000 sq in. of electronic circuit panels can be produced each day in its plant, Die-Form Circuits, Inc., reports. This capacity will make over 25,000 average size panels each day.

All panels will be made by a new process which is less expensive and yields panels with improved electrical and physical qualities, according to Jack Zimmerman, company president.

Zimmerman (pictured at left, with tool engineer Joseph Nivilinsky) says the new molded circuit costs less due to savings in raw material. There are also 80 percent savings in tooling costs.

The circuit is formed by molding a phenolic resin panel with depressions for the circuit configuration. Holes are also molded for the interconnection of circuitry from one side of the panel to the other and the insertion of component parts terminals in the panel. The conductors are plated in these depressions and hour-glass shaped holes. Circuit components can be soldered with automatic machines or by hand, firm says.

With the process, circuitry can be applied on both sides of the panel at the cost of one sided foil laminated panel circuits, says Zimmerman. Two sided circuitry permits more complex circuits to fit in a given space.

Launch New Research Group

EIGHT scientists recently pooled their efforts to provide an answer to the research problems of growing technical firms in the New York area. The newly incorporated Manhattan Physical Research Group is located at 556 W. 191st St., New York City.

MPRG is prepared to initiate research programs in acoustics, solid state, data processing and other fields, and carry them through to the model stage.

Founder and president of the group is Cyrus Adler who has taught physics and electronics at C.C.N.Y. and RCA Institutes. Gerard G. Harris, the group's v-p, is affiliated with U. C. Berkeley's Radiation Lab and the Brookhaven National Labs.

Conrad Expands

IN Holland, Mich., Conrad, Inc. subsidiary of Crampton Mfg. Co., announces the third building expansion within three years to accommodate the increased volume of orders for environmental test cham-

(continued on page 40)

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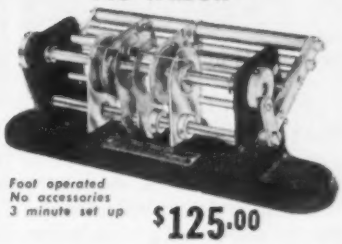

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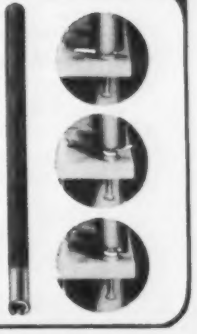

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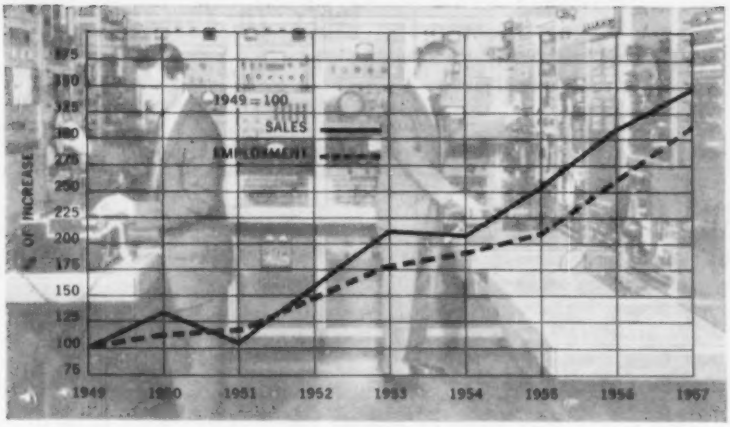

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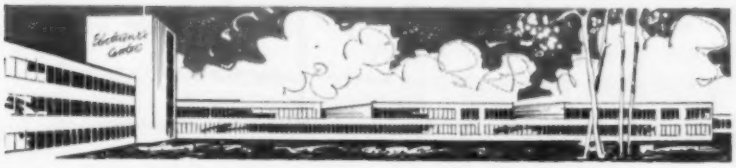

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bers. The new plant addition will permit building three large walk-in size altitude-temperature chambers simultaneously. This is an addition to the present plant space, which accommodates the manufacture of two large walk-in chambers simultaneously, and approximately forty smaller size environmental test chambers.

Division Mgr. Named a V-P

THE BOARD of directors of Servomechanisms, Inc., Hawthorne, Calif., recently elected Gerard Q. Decker (picture) a vice president. He had been division manager of the company's subsystems division. Prior to joining Servomechanisms in 1955, he was an executive of the Rheem Mfg. Co., government products division.

Sylvania Opens New Data Lab

SYLVANIA Electronic Systems Division just opened its new Data Processing Laboratory in Needham, Mass. Headquarters of the division are in Waltham, Mass.

Henry Lehne, division vice president and general manager, said 102,000-sq ft facility will house development and production of data processing for Air Force Ballistic Missile Early Warning Systems and Army's Mobile Digital Computer.

Nearly 200 employees from Waltham labs—40 percent of them engineering personnel—will be transferred initially to new facility, which will eventually employ about 500.

Plant Briefs

Audio Equipment Co., Inc., has begun operations in its new enlarged quarters at 75 Harbor Road, Port Washington, N. Y. The company had been located in Great Neck for the past five years.

Dalmo Victor Co., division of Textron, Inc., Belmont, Calif., has established a new engineering laboratory in Monterey, Calif., to broaden the company's participation in missiles and space technology.

News of Reps

Knoblock & Malone, Inc., now represents Pulse Engineering, Inc., Redwood City, Calif., manufacturer of pulse transformers, filters and toroids. The reps cover Illinois, Indiana and Wisconsin.

Power Sources, Inc., Burlington, Mass., selects **Specialized Electronics Corp.** as rep in Mississippi, Alabama, Georgia, Tennessee and the Carolinas.

Instrument sales of Sun Electric Corp., Chicago, Ill., are being handled in Colorado, Utah, New Mexico and Wyoming by **McLoud and Raymond Co.** The **Harry A. Moore Co.** of Phoenix will represent the company in Arizona. Kansas, Nebraska, Missouri, southern Illinois and western Iowa will be covered by **Forristal-Young Sales Co.**

Al Friedman, formerly of Electra Tech Associates, has formed **A. Friedman and Associates,** manufacturers' reps. Location is 187-61 Hollis Ave., Hollis, N. Y.

Appointment of the **Gerald B. Miller Co.** as sales reps for Calif., Oregon, Idaho, Nevada and Wash. for its magnetostrictive delay lines and associated equipment is announced by Deltime, Inc., Mamaroneck, N. Y.

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APR. 25	MAY 2	MAY 9	MAY 16
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Attila Attacks!

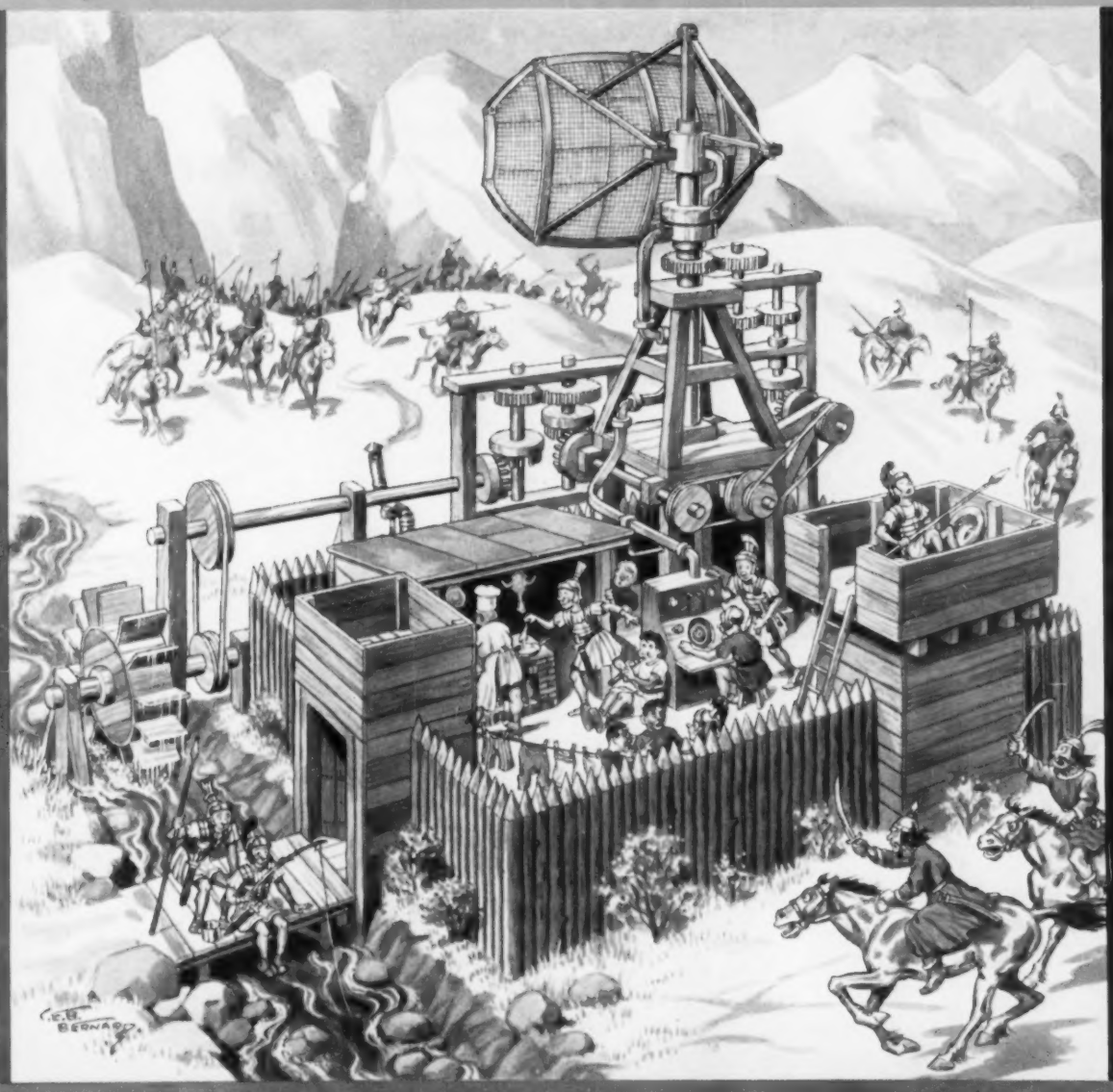
In 452 A.D., the Romans — attempting to stop the fearsome Attila's attack on northern Italy — developed one of the most remarkable military weapons of all time. They called it "nosar" ("sonar" spelled sideways).

"Nosar" was a radar-like device that took advantage of a characteristic peculiar to the Huns: the fact that these hordes of unwashed barbarians gave off an aura so awesome it was capable of paralyzing a small dog at 300 feet. Thus, "nosar" — which could detect and record on its "nostrilloscope" the tell-tale scent of a single Hun at 10,000 yards — seemed the perfect defense weapon.*

Yet, here comes Attila — virtually at the gate of the garrison — and nary a pip shows on the "nostrilloscope"! The horrible Hun has played the dirtiest trick of all — he has ordered his troops to undergo a mass bathing! The garrison is doomed.

The Romans had some consolation, however — Attila and most of his troops fell victims to pneumonia long before they reached Rome. Sometimes, the bath is deadlier than the sword.

No. 7 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES



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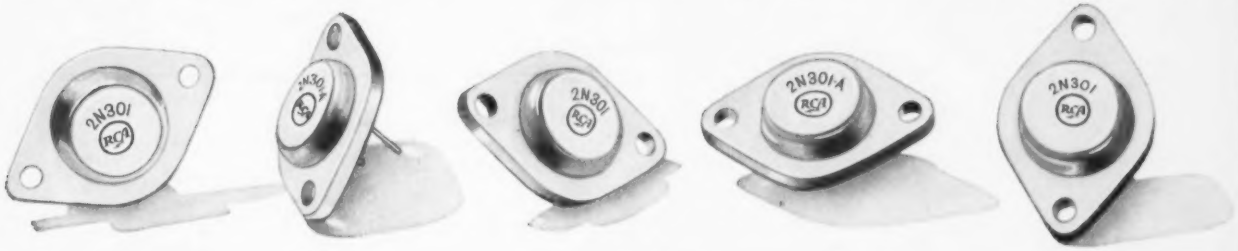

Power Output!

New, improved RCA-2N301 and RCA-2N301-A—now can provide an audio-frequency power output up to 5 watts in class A service at a mounting-flange temperature of 80°C—a significant increase (85%) over the original class A power output of 2.7 watts! These two units offer high reliability, high power efficiency, and low-distortion characteristics in power output stages of automobile radios, high-fidelity amplifiers, juke boxes, intercoms, PA systems, marine and mobile communications equipment, and electronic musical instruments.

RCA also announces the addition of three types to its expanding line of POWER OUTPUT TRANSISTORS: 2N176, 2N351, 2N376. For additional information on these types and the complete line of RCA transistors, contact your RCA field representative at the field office nearest you. For technical data on RCA POWER TRANSISTORS listed above, write RCA Commercial Engineering, Section G-19-NN-2, Somerville, N. J.

MAXIMUM RATINGS				TYPICAL OPERATION*		
				Class A Service		Class B Service
Type	Collector* Dissipation Watts	Peak Collector-to-Base Volts	Peak Collector Current Amperes	Max. Sig. Power Output Watts	Power Gain db	Max. Sig. Power Output (2 transistors) Watts
2N301	11	—40	—3	5	33 at 5 watts	12
2N301-A	11	—60	—3	5	33 at 5 watts	12
2N176	10	—40	—3	2	35.5	—
2N351	10	—40	—3	H	33.5	—
2N376	10	—40	—3	4	35	—
*At mounting flange temperature of 80°C						

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